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Contributions.

M. N. FORNEY'S IMPROVED TANK LOCOMOTIVE.

An ordinary eight-wheeled American locomotive, with four 5-ft. driving-wheels and 15x22 inch cylinders, weighs in working order 58,000 lbs., of which about 36,000 or *less than two-thirds*, is carried on the driving-wheels. A four-wheeled switching engine which weighs 18 tons has all its weight on the driving-wheels and consequently will draw as many cars as an eight-wheeled locomotive weighing 29 tons.

Many persons will therefore feel disposed to ask "If the light locomotives will do the same work as the heavier ones, why are they not used for ordinary traffic?" By comparing fig. 2 and 3—which are outline representations of common four and eight-wheeled locomotives—it will be seen that the distance from centre to centre of the front and back wheels, or the wheel-base, of the engine shown by fig. 2 is very short as compared with that represented by fig. 3. On account of the shortness of its wheel-base, the four-wheeled engine is very unsteady—just as a horse car is—at high speed or on a rough track. It is necessary to place the wheels close together in order to pass around short curves easily. Nearly all practical men know this by experience, but the *reason why* it is necessary is not so generally understood. This we will try and explain. In fig. 4 m, n, and m', n', represent two curved rails. In order that a pair of wheels may roll around a curved track with the greatest ease, it is necessary that the centre line of the axle should constantly assume the position of a radius to the curve. The plane of the wheels will then stand parallel to the rails at their point of contact, but if the axis of the wheels does not conform to the radius then the wheels as shown at c, d, will stand at an angle, and in rolling around the curve, one of the flanges will impinge against the rail, causing an abrasion of both the wheel and the rail in proportion to the degree of their inclination to each other. When two or more pairs of wheels are connected together with cranks and rods, their axles must all be held rigidly in a position parallel to each other; and as any of the radii of a curve—o, a, and o, c, for example—are more and more inclined in relation to each other, the greater the distance a, c, between them at their point of intersection with the curve, it is obvious that the farther the axles are spread apart, the more will they depart from the position of radii, and consequently the greater will be the angle of the wheels to the rails*. It is therefore necessary in locomotives which have all their wheels connected to make the wheel-base comparatively short, otherwise they would not run around short curves without much difficulty and injury to the track. So great is the objection to spreading the wheels far apart, that in this country in order to have a long wheel-base, without incurring the difficulty described, nearly all locomotives which are designed to run at any speed have been built with a truck, which is connected to the engine so that the wheels can adjust themselves to the curvature of the track. It is found to be necessary in order to keep the truck on the track to load it with about one-third the weight of the locomotive; which of course reduces the weight on the driving wheels, and consequently their adhesion, in proportion to the weight of which they are thus deprived. Or in other words, more than a third of the weight of the engine is sacrificed in order to have a long and flexible wheel-base and a steady-running engine.

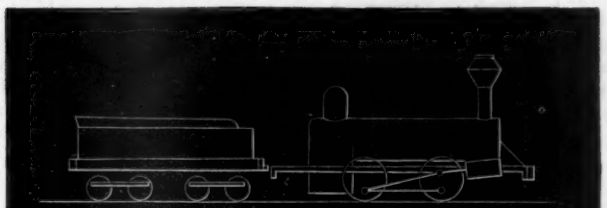


Fig. 2

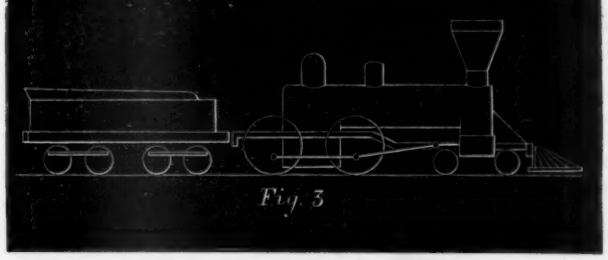


Fig. 3

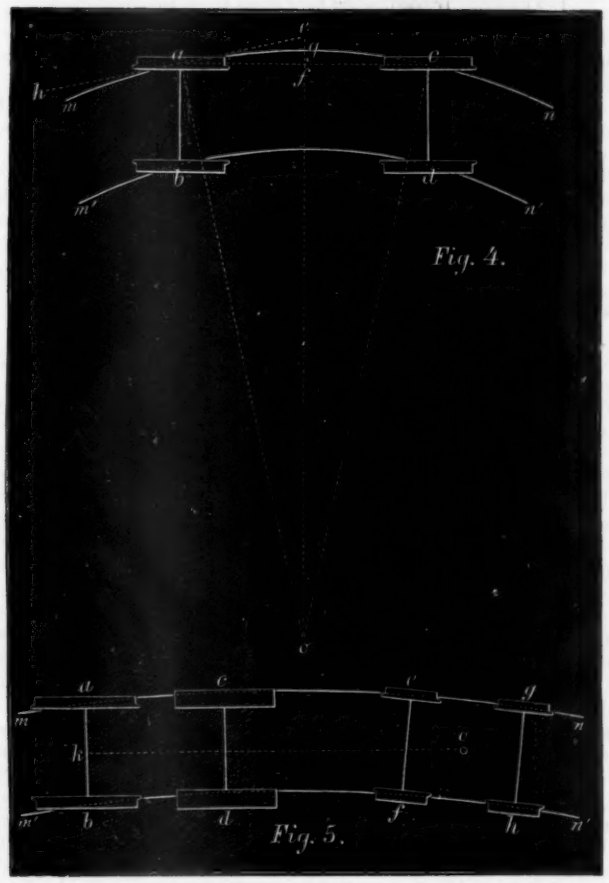


Fig. 4.

Fig. 5.

It was to overcome this evil that the locomotive represented by fig. 1 (see supplement) was designed. By this plan not only is all the weight of the boiler and machinery carried by the driving-wheels, but by extending the frame beyond the fire-box far enough to receive the tank, and placing a truck underneath to carry the weight of water and fuel, we get a long wheel-base which adjusts itself to the curvature of the track, while at the same time the whole weight of the engine proper is carried on the driving-wheels, the same as on the four-wheeled engine, fig. 2. It will be observed that by this means we secure *the steadiness of the eight-wheeled locomotive and the adhesion of the one with four wheels.* The accompanying table will show the relative weights of an eight-wheeled engine and tender of the dimensions we have described and one of the improved tank locomotives:

	Total weight with water and coal.	Weight on drivers.	Weight without water or fuel.	Diameter of driving wheels.	Size of cylinders.
Ordinary 8-wheel engine and tender	98,000 lbs.	36,000 lbs.	70,000 lbs.	62½ in.	15"x22"
Impr'v'd tank engine	70,000 lbs.	42,000 lbs.	48,000 lbs.	50 in.	14"x20"

It will be seen from this comparison that while the total weight of the tank locomotive is 70,000 lbs., or nearly 30 per cent. *less* than the other, it has at the same time over 15 per cent. *more* weight on the driving-wheels; and after deducting the weight of water and fuel carried by each, the amount of material in the tank locomotive is 22,000 lbs., or more than 30 per cent. *less* than in the other. As the cost of locomotives is dependent to a certain extent on their weight, the lighter machine can be built at considerably less cost than the other.

An incidental advantage is also gained by reducing the weight, besides the saving in cost. The load which a locomotive draws is *its own weight* in addition to that of the train, therefore it is obvious if the one be reduced the other may be increased by the same amount, and the total weight drawn will be the same in each case. In other words, if the weight of a locomotive is 22,000 lbs. less, and its capacity the same, it can draw 22,000 lbs. more paying freight.

On tank locomotives, the weight of the water and fuel—which is variable—should never be carried on the driving-wheels, because if it is, either the weight on them will be too great when the tanks are full, or too little when they are empty. In the one case the locomotive will injure the track; in the other it will not have enough adhesion when the water and fuel have been consumed.

On the heavy grade of the Pennsylvania Railroad, difficulty was experienced from this source with tank engines built for drawing trains up the mountain grade from Altoona westward. They would take the train without difficulty when they had a full supply of water and coal, but had not enough adhesion when they approached the top and their tanks were empty and fuel consumed. This evil is entirely obviated in the improved tank locomotive which we have described and illustrated on plate 1. All the *permanent weight* of boiler and machinery is carried on the driving-wheels, and the water and fuel, which are variable in quantity and weight, on the tank. This *combination of advantages*, it is conceived, is an important feature and one peculiar to this plan of locomotive.

Railroad engineers know from experience that it is always safer to run an ordinary locomotive on a crooked road with the truck ahead than behind. The source of danger is not the position of the truck but the rigidity of the rear wheels. It has been shown that the angle which two pairs of wheels whose axles are held rigidly parallel to each other will bear to a curved track is due to their wheel-base, or the distance apart of

*This can easily be demonstrated mathematically. Suppose m, n, and m', n', Fig 4, to be a curved track, and e, o, a radius of the curve, and a, b, and c, d, two pairs of wheels and axles the latter parallel to and about equi-distant from the radius e, o. Now, in order that the wheels a, and c, may run on the same right line or "track," they must be in the same plane and perpendicular to their axles. If, therefore, we draw from a,—the point of contact of the wheel with the track—a line a, c, perpendicular to a b, this line will lie in the corresponding planes of the two wheels, and be perpendicular to their axles, and to e, o. From a, and c, draw the radii a, o, and c, o, perpendicular to a, o, and tangent to the curve at a draw h, e. Now as a circle is perpendicular to its own radii, at their point of intersection, the tangent h, e, and the curve must coincide at the point a,—therefore, the angle which the line a, c, lying in the plane of th wheel, makes with the tangent h, e, must be the same angle that the wheel makes with the curved track.

In the triangle a, f, o, the angle o, f, a, is a right angle, therefore—

the angle o, a, f, + f, o, a,—a right angle.
But as o, a, f, + f, a, e,—a right angle
$\therefore$ f, a, e, must equal f, o, a.

But the angle f, o, a, is measured by a, g, one-half the arc subtended by the chord a, c, which equals the distance between the axles; and, as the length of an arc increases with the length of its chord, therefore, the greater the distance between the axles, the greater the angle f, o, a, and consequently f, a, e, or the angle of the wheel with the rail.

their axles. This distance in a locomotive with four driving wheels and a truck, fig. 5,* attached to a rigid frame, is measured by the distance *k, o*, from the centre of the rear axle to the centre of the truck. The inclination of the driving-wheels to the rails on a short curve is consequently very great, and in the same degree will be the abrasion of the flanges and the track and the danger of running off, if the engine is run with the driving-wheels in front. The evil and danger will not be so great if, instead of being the leading wheels, they are behind or "trailing." It can be seen from the diagram that when the engine is running with the truck ahead, the motion of the wheel *a* is *from* the rail, instead of against it as it would be in moving in the opposite direction. At the same time the centrifugal force of the locomotive caused by running around a curve has a tendency to carry the wheel *p away* from the rail. The flanges of the trailing wheels will therefore obviously not impinge against the rails so much when the locomotive is running forward as they do in running the other direction. When *a* and *b* are in front, the whole strain of guiding the engine is borne by the flange of the wheel *a*. When the truck is in front, it adjusts itself to the curve, and not only are its wheels, therefore, more nearly parallel with the rails, but the strain of guiding the locomotive is then divided between the flanges of the *two* outside truck wheels *l* and *g*. As they come in contact with the rail at a much less angle than the trailing wheels *a* and *b*, the abrasion of the track and the danger of running off are much less than it is when the driving-wheels are in front.

For these reasons the tank engine which we have described has been designed to run with its truck ahead, and as one of the essential features of the plan is to carry the boiler and machinery—whose weight is permanent—on the driving-wheels, and the water and fuel, which are variable, on the truck, therefore running the locomotive in this way reverses the positions of the different parts and brings the boiler, smoke stack, etc., behind. Although this may at first sight strike persons unfavorably, the objections to doing so are thought more imaginary than real, and on consideration it is thought it will be found that some important advantages are gained by doing so.

The most noticeable of these is the influence which the motion of the locomotive (in the opposite direction to that of the air and smoke in the tubes) has on the draft. When a locomotive runs with the smoke-box ahead, the smoke in the tubes moves in the *same* direction as the locomotive—consequently the draft created by the movement of the latter *retards* the draft in the tubes. When the locomotive runs in the contrary direction, its motion *stimulates* the draft. In other words, if the locomotive runs at a speed of say, forty feet per second, with the smoke-box ahead, and the smoke passes through the tubes at the same rate of speed its actual velocity would be eighty feet per second; but when running in an opposite direction, the smoke may in reality be stationary, and yet pass through the tubes at a speed equal to that of the locomotive, or forty feet per second. The draft will therefore obviously be improved, by running with the fire-box in front, and consequently the exhaust nozzles will be enlarged, thus reducing the back pressure on the pistons and increasing the efficiency of the engine.

There is also an advantage in having the water-tank in front and the boiler and smoke-stack behind. The view of the track is thus entirely unobstructed and there is no liability of its being obscured by smoke or escape steam. The latter is frequently a serious annoyance, especially in cold weather, when the condensed water freezes on the cab windows.

The cab of a tank engine of this plan can be entirely closed up in cold weather, as it is not necessary to keep a communication to a separate tender open, as on an ordinary engine. In summer the hot air from the boiler is carried *out* of the cab by the motion of the engine instead of into it, as is ordinarily the case. The cab is thus warmer in winter and cooler in summer. The footboard, instead of being at the extreme back end, is between the driving-wheels and truck, or near the centre of the engine, which is much the steadiest part of the machine, and consequently the most comfortable place for the engineer and fireman. The fact of running locomotives of this plan "backwards," it is therefore thought, instead of being a disadvantage, is rather in their favor. What is gained by doing so, however, is merely incidental; the most important feature of the plan, and that which was especially aimed at in its design, is the great reduction in weight and cost as compared with ordinary eight-wheeled truck locomotives now in general use.

*Fig. 5 is a diagram showing a plan of the wheels and rails.

The writer desires to correct the impression, to which most persons seem to be liable, that these engines are designed especially for "switching." They answer a very good purpose in that service, but are intended for general freight and passenger business. They will do *any work* which can be done by ordinary locomotives of not over 28 to 30 tons weight, and are especially adapted for light traffic or branch road service.

Engines of this plan, of various sizes, from 12 tons weight up to 35, and with cylinders from 6 to 15 in. diameter, can be furnished by

M. N. FORNEY, Mechanical Engineer,
No. 72 Broadway (Room 7), New York.

A CHAPTER ON SNOW-PLOWS.

BY WM. S. HUNTINGTON.

When we consider the enormous expense and great annoyance to which many of our railroad companies are subjected on account of snow, it is a matter of surprise that so many roads in snowy localities are so illy prepared for winter traffic. There is nothing of equal importance connected with railroad management so generally neglected as the timely provision of efficient apparatus for removing snow. Some of our roads are troubled with snow to such an extent that they are blockaded for weeks in succession, winter after winter, and yet the managers of these roads do not seem to make any effort to provide the necessary appliances for removing snow. It is true that in some localities it is a difficult matter, even with the most approved apparatus for clearing track, to run trains with any degree of regularity; but that traffic should be entirely suspended, as is frequently the case, is wholly unnecessary. This may seem rather a broad statement to those who have "stayed out" for days at a time in severe storms and well nigh perished from cold and starvation, which has been the experience of the writer on more than one occasion, but later experience proves that, with proper precautions and the employment of snow-plows of the most approved construction, there is hardly any depth of snow that would seriously impede traffic.

The practice of building snow-fences has proved beneficial, and, although they are expensive to build and keep in repair, the money expended on them has proved to be well invested, when they have been substantially built and properly placed. It is not advisable, however, in some localities to depend wholly on these structures for protection, for in cases of heavy falls of snow, unaccompanied by wind, the track is covered to a considerable depth, and plows must be brought into requisition for its removal, or the more tedious and expensive operation of shoveling must be resorted to.—The annual reports of Massachusetts railroads for the five years ending in 1859 showed that the greatest expense of removing snow was, for any one year of the five, $68 per mile; while for the years attended with the least expense it was $13 per mile. This was an unusually mild winter in that locality, and the average yearly expense was far above that sum. My memory fails to give the average but I believe it was "among the forties." At all events the cost of cleaning snow was a serious affair for some roads, and it served to awaken an interest in improvements in snow plows and the construction of snow fences.

A great deal of thought has been expended by railroad mechanics in their efforts to produce snow plows that will answer all the requirements for clearing track, and a few have been successful on roads that are not seriously troubled with snow, and are provided with an abundance of locomotives, so that they can "double-up" in snowy weather. In other localities the extra engines, or the *half dozen or more extra ones*, often fail to come to time; the huge, ill-shaped monster before them proving too much for their united efforts to push through a narrow cutting with the snow jammed hard against its sides. There are certain mechanical principles necessary in the construction of a snow plow to secure efficiency, and as the season is now at hand when railroad mechanics will have their attention called to improvements in these indispensable appliances, I will offer a few hints on the subject. Old plows will now be overhauled for repairs, or new ones constructed, and as it is no child's play to build a good snow plow, a few remarks on the subject may not be amiss.

It is a common fault with most snow plows that they are built wedge shaped, with a view to *push* or *throw* the snow on one side, or rather on both sides on a single track. On double tracks the same principle is used, except that the plow is made in the form of half a wedge, so as to throw the snow all on one side. Such plows answer a good purpose in a moderate depth of snow, but in cuttings where it is drifted badly they are almost a nuisance. A plow should be so constructed as to *raise* the snow before throwing it on one side. There would seem to be no difficulty in constructing a plow that would raise snow to a height of twelve or fifteen feet, and perhaps twenty, before casting it on one side. Indeed, there would be no difficulty in *raising* the snow to any height desired, but doubtless some difficulty would be experienced in raising it to a greater height than fifteen or twenty feet, and at the same time casting it on one side a distance sufficient to lodge it on the bank in such a manner that it would not slide back under the wheels, as it does with most plows in use. With a properly constructed plow a velocity of fifteen miles per hour would raise snow eight feet and cast it clear of the track. A velocity of twenty-two miles per hour would raise it sixteen feet, and at thirty miles per hour it would be raised thirty feet with a suitable contrivance to conduct it to that height. It is, however, obviously impracticable to construct a *shute* and maintain it at that height, and if it were possible it is hardly desirable, inasmuch as on most roads where much trouble has been experienced from snow in deep cuttings snow fences or sheds have been erected, which render the use of a plow constructed to raise snow to any great height unnecessary. A plow that will effectually remove the snow from a cut of fourteen feet in depth, or the height of an ordinary locomotive smoke-stack, when the cut is filled with snow to the depth of ten feet, is among the possibilities, and who is the lucky man that will bring it out the coming winter?

This would not be considered a remarkable performance for some plows already built, in cuttings of two or three hundred feet in length, but for a distance of half or three-fourths of a mile through heavy cuttings, in some localities, there is a demand for better plows than any now in use.

The idea of *raising* the snow before carting it aside is not entirely new, but such plows as have been built on that principle have a fault in common with other plows, *i. e.*, in leaving the sides of the snow cut vertically, causing the snow to slide back on the track, which is, in many cases, the real cause of the detention of trains. Of course the snow is raised simply by making the front of the plow an inclined plane; but it should be of such form at its edges as to give the snow cut a slope. This would in a great measure prevent snow from sliding back when once removed and obviate the necessity of shoveling it out by hand labor. This can be accomplished by wings of suitable shape attached to the edges of the inclined plane, and so arranged as to be closed in passing bridges, station buildings, narrow rock cuts, etc.

In some localities, especially among hills and mountains, a plow is required that can be readily adjusted to cast the snow on either side of the track, as, for instance, when the track comes to the left around the side of a hill or mountain, it is required to cast all the snow to the right; while the next, or some other curve, will run to the right—and the *chute*, or conducting apparatus, will need to be changed to cast the snow to the left. Trains are frequently blockaded in passing around a hill with only a small quantity of snow on the track—even with one rail in sight. In such cases the ordinary plow, constructed to cast snow on both sides of the track is entirely worthless, for reasons which are clear to any experienced railroad man. A plow that will cast snow on either side, as may be desired, and one that can be readily adjusted for the work, is much needed in a large portion of the United States and the Canadas. In some sections a "snow excavator" or "scoop" is wanted, one that may be run into a deep cut, loaded and backed out, and the snow dumped out of the way. There is something on the "scoop principle" now in use, but it does not seem to come up to the requirements. Let us have something better in this line, something that will "scoop" out the worst kind of a cut in a few minutes. It can be done, and all that is needed in the line of snow plows will be forthcoming as soon as those most interested show a proper interest in the matter.

The above are some of the most important features to be considered by those who are about to provide plows for the coming winter; but as the requirements of a first-class "big snow plow" differ widely according to climate, location, etc., it is not best for railroad men to follow strictly the design or principle adopted by other railroads, however efficient they may be, unless their roads are similarly located in regard to snow. Thus, to illustrate: the New York Central in crossing the entire State does not encounter sufficient snow in ordinary winters to seriously impede traffic, while some of its branches, or connecting lines, are seriously troubled and require plows of vastly different proportions, and it would be folly for some roads connecting with that line, or running at nearly right angles to it, to undertake to keep their roads open with the style of plows in use on that road. Of course the frequency of trains on

the Central is greatly to their advantage in regard to blockading, but their principal advantage over other roads in this respect lies in the fact that severe storms usually travel in a line parallel to the line of road, rather than across it. Thus it is well for mechanics who are designing plans especially for their roads, to study carefully any peculiarities of their lines such as climate location, direction, cuttings, bridges, etc., which will assist them in designing a plan answering all their requirements, regardless of what may be in use on other roads differently situated in neighboring localities. Of course it is advisable for railroad mechanics to look about them and see what their neighbors are using, and they may get some valuable ideas by so doing, but they should keep their own requirements in view.

It is not altogether the great expense attending the removal of snow, or the annoyance and trouble caused by the delay of trains, that should stimulate railroad men to the timely provision of snow plows, but the blockading of trains by snow is frequently the cause of serious accident. Indeed it is a rare occurrence that a severe storm—a regular blockader—passes without serious disasters, by means of collision and otherwise, with a dozen or more trains on the road, all of them out of time, a blinding snow storm prevailing and the telegraph down, it is rather ticklish business for engineers and train men, and in such cases (and they are by no means rare) a good snow plow may save a thousand times its cost.

"But you will ask, "What are we going to do with the big plow in such cases? We can't clear the track for every train with a big plow." I will answer as the great General, who didn't capture Richmond, is said to have done while on board a gunboat. After sitting a while in silence someone asked what he was thinking about. "Gunboats" said he, "are a big thing; every family ought to have a gunboat." Now I am not going to say that every locomotive ought to have a gunboat attached to its front during the winter, although I have no doubt it would answer as well for a snow plow as some that are now in use. I will say however that every locomotive ought to have a snow plow—one of those neat little affairs that take the place of the pilot. Some roads are equipped with these plows, which are attached to the truck frame by the same bolts that hold the pilot, and a few minutes only are required to remove the pilot and put the plow in its place. This should always be done on the first indications of a snow storm, *or a little before it*, in preparing for winter, and the plow allowed to remain until it is certain that spring has come, when it should be housed until wanted again. When all locomotives are provided with these little plows they will make time through an astonishing depth of snow, and no road that ever experiences the least trouble from snow should be without them. "Fighting" snow all winter with a cow-catcher it unprofitable, yet it is practiced winter after winter on many roads to their great inconvenience.

Bring out your snow plows and prepare for winter.

IRON AND STEEL RAILS.

Homogeneous Iron Rails--The Construction of the present Railway Rail--Bessemer Metal for Rails &c.

PITTSBURGH, October 20, 1870.

Probably no brief paragraph has ever excited more interest and attention than a short extract from the annual report of H. Blackstone, Esq., of this city, Chief Engineer of the Allegheny Valley Railroad, made to his company in March last. It has been published in most of the daily papers, as well as those journals especially devoted to mechanical and railway interests, both in this country and Europe. It was inserted in the RAILROAD GAZETTE some time ago, and was reviewed by a Rock Island correspondent who did not make his purpose in doing so very clear by what was said.

Webster defines the word "homogeneous" to mean "all of one quality or grade," and this is certainly correct. Railway rails as now made, are not homogeneous at all. The iron of which they are composed passes direct from the puddler to the "Squeezer" and from thence to the rolls, where it is rolled out into flat slabs or bars. These are assorted, the hardest being selected for the crown, and the softest and longest for the base of the future rail. The slabs are then cut up and piled into a fagot large enough for a rail, which is again heated up in a furnace and rolled out. This process presses and squeezes together the slabs of which the rail is composed, but seldom or never welds them together completely, as may be seen any day on any well-worn railroad track. When the hard outer shell of the crown wears away, the soft layers beneath laminate and scale off very rapidly. The top is soon entirely desoloyed, while the base is still as sound as the day when it was laid.

Notwithstanding the above defects, the process of cutting and piling slabs for rails has many advantages which will cause it to be adhered to, the principal of which is that iron thus prepared is very much cheaper than that which goes under the hammer and is consolidated by it into a solid bloom. Much of the cinder and scale is kept in the rail that would otherwise be beaten out. Breakage is to a great extent avoided by the longitudinal course of the fibre of the metal. The work can be much more rapidly and in consequence more cheaply performed.

In Mr. Blackstone's experiment, as narrated by him in his last report, hammered blooms of good commercial iron were carefully welded together until a mass large enough to form a rail was obtained. A number of these were sent to a rail mill and rolled into rails. They were then placed in the most trying part of the track of his road, where they have worn out a set of steel-headed rails and two others of iron, and are still as good, apparently, as ever, there being no appearance of scale or exfoliation, or breaking down. It is Mr. B.'s opinion that if good iron rails, properly prepared, are used, the present mainia for expensive Bessemer steel rails may be dispensed with, and that homogeneous iron will be found equally enduring and serviceable at much less cost.

There are serious objections to rolling solid rails, if the process be not conducted with the most perfect good faith. The present rail, like every thing else connected with the railroad system, has increased in weight till a mass of iron weighing 700 to 800 lbs., including waste and slag—entirely too heavy for the workman to handle with the present appliances—is required to make a rail nine to ten yards long and weighing 55 to 60 lbs. to the yard. To weld small masses together is dangerous, for the slightest vertical fissure or imperfection endangers the rail in its most vital part. It has been satisfactorily shown that no amount of mere pressure alone, no matter how great it may be, will make a perfect weld. This must be done under the hammer, the blows driving the fibers of the two pieces of metal into and through each other by the force of the impact completely consolidating them at a bright white heat, the metal being as free from cinder, slag or oxide, and the fuel from sulphur, as possible. A valuable paper on the welding and handling large masses of puddled iron was recently published in the London *Colliery Guardian* and republished in various journals of this country, showing that this most important subject has attracted the attention of practical men abroad as well as in this country. When railway managers generally cease to regard cost alone as the sole requisite, and buy their rails by guaranty, requiring endurance as part of the contract, much greater progress will be made in this direction.

Bessemer metal, a sort of amorphous steel has become quite the fashion within a few years, and now seems to be regarded by railroad men as a panacea for all the ills that railroad iron, like everything else mortal, is heir to. As a novelty it may have a run, but it is quite clear already that most of the merits of this rail are due to the fact that it is homogeneous. When the converting process is completed, the molten mass is poured into moulds, each cast from which makes an ingot heavy enough to make a rail. This is afterwards heated up and rolled, out so that the whole rail is solid alike, both crown and base. Bessemer metal does not seem to be very highly regarded for other purposes where the usual low priced pig metals are used. Reports made to the Philadelphia Master Mechanics Convention represent it to be no better than hammered iron for car axles. The Paris Omnibus Company tried and discarded it for their horses shoes. Like most other articles of the sort its chief value lies in making it faithfully and of the very best materials, free from all the great enemies of the metal worker. Lieut. Col, Dutton, of the Ordnance Corps, U. S, A., has carefully observed the chemistry of this process, and pronounces it to be nothing more or less than "cast wrought-iron!" a verdict which most practical men will finally pronounce to be correct.

It is, I believe, true that an additional expense or cost of a fraction of a cent a pound, or $5 to $10 a ton, would furnish a homogeneous iron rail of the usual size, compacted under the hammer, and alike throughout, without scale, lamination or exfoliation no matter how much wear comes on it. When railway managers want such a rail, it is only necessary for them to order it with guaranty as to welds, &c., pay the slight extra cost, to secure a rail almost if not quite as safe and durable as any made from high priced Bessemer metal, costing double the price of ordinary iron.

OCCIDENT.

THE PREVENTION OF ACCIDENTS.

WALLACE, Kansas, November 1st, 1870.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of September 24 I notice an article suggesting an association of railroad officers for the purpose of preventing accidents; yet the very men who have to bear the burden in all railroad accidents are not mentioned in your article. These men are the supervisors or road masters, who are directed by theorists or inexperienced men or else working with their hands tied for false economy or by reason of a penny-wise or pound-foolish policy. While these men have charge of a roadway with poor drainage, bad surface and line, without the means to better its condition, the results are as follows: 1st, 20 per cent. more wear on rolling stock, and the engines cannot pull so much, for the grades are doubled when the track is in bad surface and line. 2d. Flat wheels, trucks out of square, outside-bearing down so hard that trucks cannot curve. 3d. The wear of the iron in track is 50 per cent. more than if in perfect order. 4th. The suggestions of the theorists or impractical men are more readily adopted than those of practical men who have spent a life-time in constructing bridges and trestles for the safe transit of life and property. You can sum up the sole cause of many accidents from the four alluded to above. Then I would ask track and bridge men if it is not time to wake up and vindicate their own rights as well as those of the traveling public.

J. MOORE JAXON,
Kansas Pacific Railway.

Destruction of French Railroads.

It is well known that the art of destroying railroads was pretty thoroughly learned during our late war. First the armies were content with taking off the rails and burning the ties. This was only a temporary obstacle, and soon the practice was adopted of making a lofty pile of the ties, laying the rails across, and then burning it. The heat softened the rails at the center, and the weight of the ends caused them to bend down to the ground. Thus rails were left bent into a V shape. But by heat or a simple machine these would be straightened, and the next advance in the art was, to provide tools by which the heated rail could be twisted. This left the iron in a very unmanageable shape, and a road thus destroyed usually remained so at least until the seat of war was shifted.

A correspondent of the Chicago *Tribune* gives the following account of the success of the French in this direction, and also that of the Prussians in restoring the roads thus destroyed.

"It must be remembered that while the German army has in this war shown itself a very apt imitator of many a good strategical point as illustrated in our late American conflict, it has not carried the art of railroading to that perfection which was such a distinguishing feature of our armies. The Prussians, Saxons, and all the rest of their allies may be, and probably are, as good fighters as our boys in blue were, but when it comes to tear up and rebuild railroads in double quick time, they are but mere tyros as compared to them. While traveling from the Meuse at Sedan, through the whole length of the Marne Valley, I was surprised to find the railroads in such good condition. Although a great many bridges, and some very costly ones, viaducts and tunnels, were entirely destroyed, still the obstructions were not so great but they could have been cleared, and the road put in good running order by any of our late army railroad brigades within the short time of two weeks. Everything necessary to run a road was to be seen in great plentitude at all stations. All it needed was men to use them. Europeans, however, have great prejudices against any but the most substantially-built stone railroad bridges, hence they rather forego the use of the road than to build temporary trestle-works or hurriedly-constructed wooden bridges. The French, on the other hand, have shown an utter lack of sense and system in their mode of obstructing the roads. They have destroyed bridges on byways and pathways by the hundred without in the least interfering with the forward march of the German army, for the simple reason that they were not on the line of march. The destruction of railroad bridges alone, from Sedan to Paris, would foot up in a loss of at least 100,000,000 francs. Tunnels that cost millions were blown up and totally destroyed. Other than railroad bridges shared the same fate. At this place, two magnificent bridges spanned the shores of the Marne, one a suspension and the other a stone bridge, the cost of which exceeded 2,000,000 francs. Both were mined and blown to atoms eight days before a single Prussian made his appearance; the houses in the immediate vicinity of the explosion were made ruins, and many had to pay the penalty of their folly with their life. Any man with the least particle of common sense should have known that the destruction of these costly bridges would not retard the advance of the enemy long enough so as to make it plausible to destroy them, for only about a quarter of a mile below the point of the stone bridge the shores of the Marne are low, and the building of a pontoon bridge was the work of but a few hours. The river not being more than 225 feet wide, another temporary bridge, to replace the suspension bridge, was also quickly built.

PERMANENT WAY.

Baron Von Weber's Experiments on the Stability of Permanent Way.

Baron von Weber, the well-known engineer and director of the State railways of Saxony, has lately published a work* on the stability of permanent way structures, which has deservedly attracted much attention amongst continental engineers, and which contains an account of experimental researches, which appear to us to be well worthy of a lengthened notice at our hands. The author states that the work originated in some investigations made by him in searching for an explanation of those railway accidents which sometimes occur from a train running off the rails when traversing a straight and level portion of the road—a class of accidents for which he considers no completely satisfactory explanation had previously been advanced. The endeavor to find such an explanation led Baron von Weber to carry out a minute and very extensive series of experiments on the stability of permanent way, and it is on account of these experiments, which make up the chief part of the book, of which we have spoken, the earlier portion of the work, however, being devoted to a history of the development of permanent way construction. Altogether, Baron von Weber's researches are of very great practical value, and this being the case, we propose in the present, and some following articles, to lay before our readers an account of them and their results.

In carrying out investigations intended to determine the power of any given permanent way to resist the strains imposed upon it by the action of the rolling stock, Baron von Weber remarks that facts have to be collected and observations made relating to the four following points :

1. The power of the rails to resist vertical and horizontal pressures.
2. The power of the joints of the rails, fish-plates, etc., to resist vertical and horizontal pressures.
3. The power of whole structure of the permanent way to resist forces tending to cause a displacement of the entire system.
4. The power of the structure to resist the loosening of the rails from the sleepers.

These various points Baron von Weber considers in the order we have named, and we shall now proceed to give a *resume* of his observations :

I. STRENGTH OF RAILS.

The strength of the rail itself is considered by Baron von Weber to be of secondary importance when compared with the stability of the permanent way considered as a whole, and we shall therefore only give a few general particulars of some of the chief series of experiments which have been made to determine this strength. The number of such experiments which have been made is very great, and there are, in fact, probably few engineers in charge of a railway who have not carried out such trials. Almost all these experiments, however, have been made to determine the resistance of the rails to vertical—or in some cases to both vertical and lateral—pressures, whilst in practice rails are subjected to very complex strains, of which it is difficult, if, indeed, not impossible, to define the precise nature and amount. Notwithstanding this, it must be allowed that many important series of experiments have at different times been made, and that these experiments have exercised an important influence in determining the three hundred and odd rail sections now in use on European railways.

The first of these series of investigations was that carried out by Mr. Peter Barlow in the year 1835, by the order of the then London & Birmingham Railway Company, and of which an account was published in reports made to the directors of that company by Mr. Barlow. These experiments were carried out to determine the pressures to which rails are subjected by loads rolling over them at high speeds; the vertical deflections produced by these loads in rails of certain sections supported at given distances; the lateral deflections of the rails produced by quickly moving loads; the comparative characteristics of the fish-bellied and parallel rails; the determination of the neutral axis for various sections of rails; the deflection of rails of different sections produced by stationary loads; and the determination of the form of section offering the greatest resistance for a given sectional area. The instruments used by Mr. Barlow in these memorable experiments were named by him "deflectometers," and they are shown in the annexed Figs. 1, 2, and 3, the first two figures representing the instrument used for measuring the vertical deflections. In using this instrument the plate, A B, was fixed clear of the rails, and the pin, E, was placed underneath the point, the deflection of which had to be measured, the movable slides, *i i*, being fixed upon the pin, H G, at such points that the lower slide kept the lever, D E, in a horizontal position. The raising of the upper slide thus showed any deflection of the point, E.

The second instrument, Fig. 3, was used for measuring the lateral deflections of the rails, and was constructed in a similar manner to that already described.

FIG. 1.

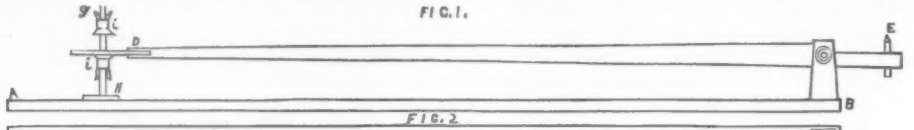


FIG. 2.

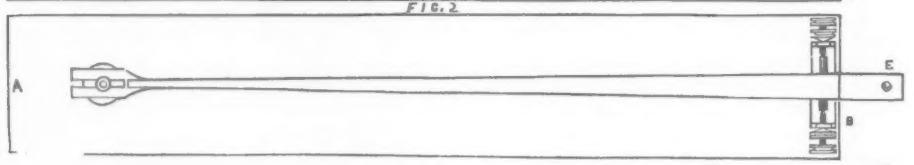
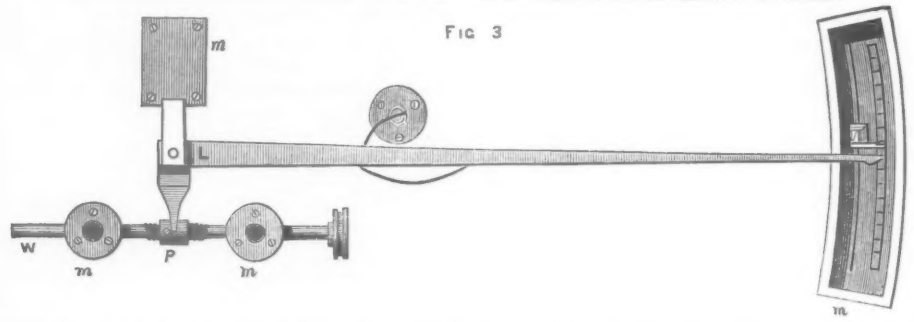


FIG 3



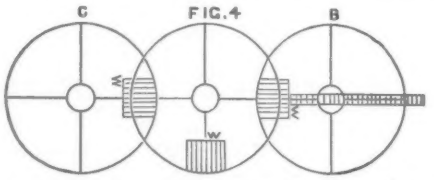
The plates *m m*, and *m*¹ *m*¹, were fastened to a body independent of the movements of the rail, and the rod, W—one end, P, of which touched the rail—was allowed to move freely on bearings carried by the plates, *m m* The central parts of the rod, W, was provided with screw threads carrying a nut with a pin, *p*, by means of which the bell crank lever, L, could be brought into such a position that the slide, *g*, on the end of the lever corresponded with the zero point on the scale. It will be seen from the figure that the action of this instrument was analagous to that of the apparatus used for measuring the vertical deflections, and by means of the two instruments the vertical and horizontal deflections of a rail caused by a moving load could be determined. Although, however, these instruments were useful for measuring deflections caused by forces acting gradually, Baron von Weber points out that they would give very erroneous results when applied to measure the results produced by loads suddenly applied, such loads causing the tossing up of the lever and the slide to a much greater height than that due in the true deflection. This, Baron von Weber considers to be the reason why Mr. Barlow found the deflections near the joints of rails to be 40 per cent. greater for a load passing over them at a speed of 20 miles an hour than for the same load applied slowly; while at the same time, he found correctly that the deflections of a rail between two supporting points were almost the same for any given load, whether that load was applied slowly or allowed to roll over quickly. In testing the joints the deflection took place rapidly, owing to the play in the various parts, and the vibration of the lever was added to the deflection of the rail. Mr. Barlow's instrument also measured the sinking into the ground of the stone blocks on which the rails were supported, and by considering these blocks to be firmly bedded he came to, what Baron von Weber considers, the erroneous conclusion that the inequalities of a rail over which a load is rolling give rise to a deflection about twice as great as would be produced by the same load applied gradually.

Mr. Barlow's experiments led him to the conclusion that, under the circumstances then existing, a distance of 3 feet between the supports of the rails was the most economical, and that for carrying a load of 7 tons, with a deflection of 0.024 in. under a load of 3 tons, the principal dimensions of the rail used should be as follows: Width of head, 2¼in., weight of head, 22.5 lb. per yard, bottom flange, 1 in. deep, 1¼ in. wide, weight of bottom flange, 12.44 lb. per yard, depth of rail, 4½ in., thickness of the web, 0.62 in., weight of the rails, 51 lb. per yard. Mr. Barlow's conclusions were also in favor of the parallel, as compared with the fish-bellied rails, and by leading to the adoption of the former class of rails, his experiments exercised a most important influence upon the early development of railway engineering.

Before leaving Mr. Barlow's experiments, and passing on to those of later date, we must mention a simple and ingenious arrangement adopted by Mr. Barlow for determining the increased resistance offered to the wheels by an increase in the deflections of the rails. This arrangement, which is shown by figure 4, consisted simply of a pair of carriage wheels having heavy weights fastened to their tires, as shown. When these weights were brought into the positions, *B* or *C*, and then released, they caused the wheels to perform a series of pendulous oscillations, and the numbers of these oscillations gave exactly the proportions of these resistances opposed to the wheels by the deflections of the rails. Baron von Weber states that he himself frequently employed this method of measuring resistances, and he considers it an excellent one, both on account of the readiness with which it can be carried out, and also on account of the facilities it affords for obtaining exactness by frequent repetitions of an experiment.

In the same manner as Mr. Barlow's experiments determined the general employment of the double-headed

FIG. 4



rail in this country, German experiments carried out with great care and skill, led to the adoption of the flat-footed or Vignoles rail, which is now in almost universal use on German railways. The experiments to which we allude are those carried out in the year 1851, at the instance of the Prussian Government, by Herr Theodor Weishaupt, these experiments having been undertaken to determine the best section of rail to be adopted for the Eastern Railway of Prussia (the first great railway constructed by the Prussian Government), a question which, after some discussion, had been left undecided at the meeting of German railway engineers at Berlin, in 1850. Weishaupt made, altogether, 128 series of experiments, each consisting of between 20 and 40 different observations made on the following sections of rails: 1. The flat-footed rails of the Eastern Railway of Prussia, the Stargard-Posen, Berlin-Hamburg, and Thurgingia & Lower Silesian railways; 2. The chair rails of the Westphalian, the Berlin-Anhalt, and Berlin-Potsdam railways; 3. The bridge rails of the Madgeburg, Leipsig, and Lower Silesian railways; and 4, The level crossing rails of the Eastern and Westphalian railways. These various rails were partly of English and partly of German make, and their powers to resist both vertical and lateral pressures were tested; but the difficulty of obtaining thoroughly satisfactory results was much increased by the imperfect manufacture of the rails at that time.

The distance between the supporting points on which the rails were placed for testing was 3 ft., and the general conclusions arrived at by Weishaupt were as follows: If flat-roofed rails are altered (by planing off the base) into chair rails, the resisting power of these rails within the limits of elasticity decreases much more quickly than their weight, and this decrease is 40.5 per cent. greater when the base is planed off level with the sides of the central web; 2. The distance of that part of the section which is subjected to tension ought to be as far as possible from the neutral axis, and this, of course, gives a flat base; 3. If the flat-footed rail is subjected to heavy vertical pressures, the outer edges of the base do not follow the vertical deflections produced by these pressures, and lateral deflections take place. This fact proves that the width and thickness of the base of the flat-footed rails must be kept within

* *Die Stabilität des Gefuges der Eisenbahn-Gleise.* Historische und experimentative Ermittelungen von M. Freiherr von Weber. Konigh Satis: Finanzrath and Staats-Eisenbahn Director, Weimar, 1869.

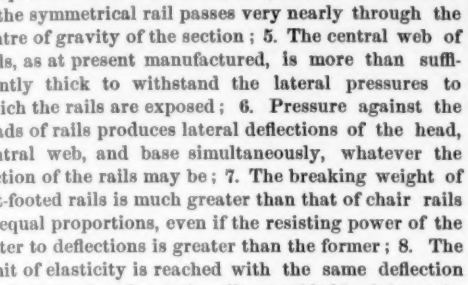
certain limits. 4. Wrought-iron rails, especially those of fibrous structure, offer about the same resistance to compression as to extension, so that the neutral axis of the symmetrical rail passes very nearly through the centre of gravity of the section; 5. The central web of rails, as at present manufactured, is more than sufficiently thick to withstand the lateral pressures to which the rails are exposed; 6. Pressure against the heads of rails produces lateral deflections of the head, central web, and base simultaneously, whatever the section of the rails may be; 7. The breaking weight of flat-footed rails is much greater than that of chair rails of equal proportions, even if the resisting power of the latter to deflections is greater than the former; 8. The limit of elasticity is reached with the same deflection for flat-footed as for chair rails, provided both have the same depth (with rails 4½ in. deep the limit of elasticity is reached at a deflection of 0.062 in.); 9. The limits of so-called "perfect elasticity" are illusionary, for after the first permanent set the measures of flexure for further loads remain the same; and 10, The lateral resistance of the flat-footed rail is greater in proportion to that of the chair rail than might be expected on comparing the width and weight of the rails. These results of Weishaupt's induced the Prussian Government to adopt the flat-footed rail exclusively for the State railways and very few railways with rails of any other section have since been constructed in Germany.

Malberg's experiments, carried out in 1857, for determining the best section for the rails of the Lower Silesian Railway may be considered as a continuation of the investigations of Weishaupt, and Malberg's conclusion was that the limit of elasticity is highest in those rails having a base of fibrous and a head of crystalline iron. Neither Weishaupt nor Malberg made experiments for determining the resulting power of the central web of the rails to lateral pressure; but in 1858 Baron von Weber proposed to the Saxon Government to alter the thickness of the central web of the normal section of rails of the Saxon State railways from 5/8 in. to ½ in., and without diminishing the weight of the rails, to add the material thus saved to the height, so as to increase their strength about 20 per cent., and this proposition being met by several objections by the administration of the State railways, he carried out a series of extensive experiments to prove the advantages of his proposals. Of these experiments we must now give some particulars.

BARON VON WEBER'S EXPERIMENTS FOR DETERMINING THE THICKNESS REQUIRED FOR THE CENTRAL WEB OF RAILS.

Baron von Weber desires to ascertain what was the *minimum* thickness which would be given to the web of a rail, in order that the latter might still possess a

Fig. 5.

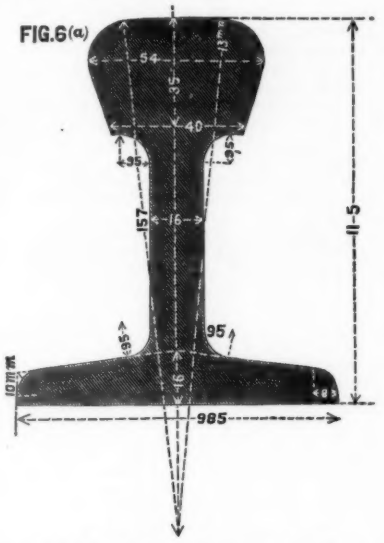


greater power of resistance to lateral forces than the fastenings by which it was secured to the sleepers. For this purpose a piece of rail 6 ft. in length, rolled of the best iron at the Laurahutte in Silesia, was supported at distances of 35.43 in., and loaded nearly to the limit of elasticity (which had been determined previously by experiments on other pieces of the same rail) and the deflections were then measured with great care by an instrument capable of registering $\frac{1}{1000}$ in. with accuracy. This having been done, the web of the piece of rail was planed down, and each time that its thickness had been reduced three millimetres, the vertical deflection of the rail under the above load was again tested, and the rail was subjected to the following rough, but practical, experiments. The piece of rail was fastened to twice as many fir sleepers by double the number of spikes which would be employed in practice, and a lateral pressure was then applied to the head of the rail by means of a lifting jack, until the rail began to cant and the spikes were drawn. The same thing was then done by a sudden pull, the apparatus used being a long lever fastened to the top of the rail, as shown in Fig. 5. The lifting jack and the lever were applied to the ends of the rail, and the web of the latter had in each case to resist the whole strain required for drawing out the spikes. The results of the experiments made to ascertain the resistance of the rail to vertical flexure with different thicknesses of web, and under a load of 5,000 lb., were as follows:

Thickness of Web.	Vertical Deflection.
	in
15 millimetres—0 59	0.016
12 " —0 47	0.016
9 " —0 35	0.019
6 " —0.24	0.0194
3 " —0.12	0.022

These results showed ample stiffness even when the web was reduced in thickness to 0.12 in. To determine the power of resistance of the rail to lateral flexure, an impression of the section was taken in lead each time that the spikes were drawn. The forces applied in these experiments were very far greater than those occurring in practice, yet it was found that with the web 12, 9, and even 6 millimetres thick, no distortion took place, and only when the thickness of the web was reduced to 3 millimetres (0.12 in.) was a slight permanent lateral deflection of the head caused just as the spikes gave way. The section shown in Fig. 6 *a* had then been reduced to that shown in Fig. 6 *b*.

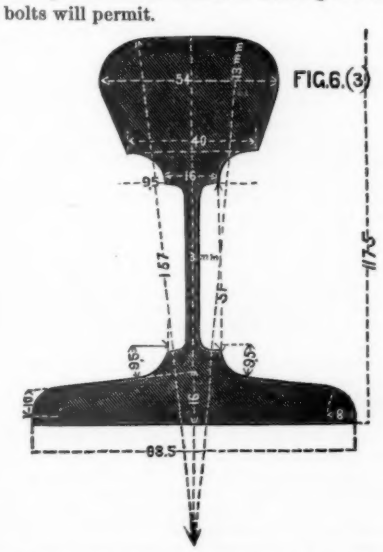
FIG. 6 (a)



Next a rail with the web reduced to 3 mil. (0.12 in.) in thickness was placed in the line leading to a turntable on the Western Railway of Saxony, where it has remained until the present time, receiving more than one hundred times daily the shocks due to engines passing to and from the turntable.

It follows from these experiments that the least thickness ever given to the webs of rails in practice is more than sufficient, and that if it were possible to roll webs ¼ inch thick, such webs would be amply strong if it were not that there would be a chance of their being torn at the points where they are traversed by the fish-plate bolts. Baron von Weber concludes that webs 3/8 in. or ½ in. thick are amply strong enough for rails of any ordinary height, and that in fact the webs should be made as thin as the process of rolling and as the provision of sufficient bearing for the fish-plate bolts will permit.

FIG. 6 (3)



Some little time ago another series of experiments on the rigidity and strength of rails was carried out by order of the Prussian Government by Herr. A. Wohler, the chief locomotive superintendent of the Lower Silesian State Railway, these experiments being made chiefly to determine the comparative value of iron and steel rails. The conclusions arrived at were pre-eminently in favor of the steel rails, the results generally being practically identical with those obtained under similar circumstances in this country. We may mention here, however, that amongst other things Herr Wohler found that the numbers of efforts of a certain force required for producing the rupture of steel and iron rails respectively were as 7 to 1. Finally, in this enumeration of German experiments on the strength of rails we have to mention those made by the Cologne-Minden Railway Company at the time when their last section of rail was decided upon. The result of these experiments was the recommendation of a diminished weight but increased height of rail, the central web being diminished in thickness to render this possible. The subjoined table gives the particulars of the sections successively adopted by the Cologne-Minden Company:

	Section No. I. 1844.	Section No. II. 1849.	Section No. III. 1853.
	in.	in.	in.
Height of rail	3.66	4.25	4.75
Width of base	3.86	3.67	3.5
" head	2.32	2.32	2.25
Thickness of the web	0.625	0.95	0.542
Weight per yard	57 lb.	72 lb.	65 ¼ lb.
Moments of bending	8.686	14.063	17.363
Proportion between weight and strength, section No I. being taken as unity	1.	1.626	2.00

It will be seen by this table that by the last alteration the depth of the rail was increased about 15 per cent., and the strength about 25 per cent.; whilst, by diminishing the widths of the head and base, and the thickness of the web, the weight was reduced about 10 per cent.—*Engineering.*

(TO BE CONTINUED.)

The Novelty Iron Works in Yale College.

The inauguration of Professor William P. Trowbridge, of New York, lately Vice-President and Superintendent of the Novelty Iron Works, and now the Professor of Mechanical Engineering in the Sheffield Scientific School at New Haven, took place on Friday evening. President Woolsey presided. Professor Lyman, on behalf of the governing board, explained the development of this new department of instruction, and Professor Trowbridge delivered an inaugural discourse. The audience was composed of the officers and students of the department, Governor English, Mr. Sheffield, Mr. Farnam and other benefactors of the institution, besides many of the leading manufacturers and citizens of New Haven.

The discourse of Professor Trowbridge was devoted to an exposition of the usefulness and dignity of the science of mechanical or dynamical engineering, to the relations of theory and practice, the proper course of study for those who would acquire this science, and finally the beneficial results which will follow the prosecution of these studies. The address will soon be published.

The Novelty Iron Works have presented to the Sheffield Scientific School the magnificent collection of mechanical drawings accumulated in that great industrial establishment during the last quarter of a century. These drawings exhibit the structure, entire or in detail, of nearly all the machinery, etc., manufactured by the Novelty Works during that period. They number many thousands of separate sheets, and will constitute in the school a library of reference-works illustrative of mechanical science. Such a collection is obviously unique, and this is probably the first instance in which a great manufacturing establishment like the Novelty Iron Works, in winding up its affairs, has bestowed its scientific collections upon a school of applied science. Theirs is perhaps the first case also in which so useful an industry as shipbuilding has been deliberately taxed out of existence.—*New York Evening Post.*

Paymaster's Car.

The new paymaster's car of the North Missouri Railroad Company is one of the most superb and capacious specimens of railway architecture yet built in the West, having compartments for the pay-office and an elegant drawing-room, which can be transferred into a most comfortable sleeping apartment, and again into a dining-car, to accomodate eighteen persons in both capacities. The cushions of the seats are downy in their softness, and the mattresses and bedding are of the most comfortable character. The car has a balcony at the rear end, whereon parties can sit and enjoy the air and scenery in warm weather with perfect safety while the train is going. There is also a kitchen, pantry and wash-room, located between the drawing-room and pay-department.

The car is set upon patent long-coupled, four-wheel trucks, which, we are assured, secure greater smoothness of movement than the six-wheel trucks. It is of massive octagon finish and of tasteful ornamentation outside; within, the panelwork is in beautiful natural grain walnut. This splendid coach was constructed throughout at the coach works of the North Missouri Railroad at St. Louis, under the special supervision of Mr. C. S. Buck, Superintendent of the works.—*Leavenworth Bulletin.*

Proposed Tunnel between Italy and Sicily.

Signor Carlo Navone, an Italian engineer, publishes at Turin a "Plan for a Submarine Passage across the Straits of Messina," with maps, drawings, &c., for the purpose of uniting the Sicilian railway system with the main lines of the Italian peninsula.

Narrow Gauges in India.

A problem of vast importance addresses itself for solution to the Government of India, one which involves, to an almost unlimited extent, the future prosperity of the country. To a certain degree the conditions and requirements of Imperial Russia and Colonial India run parallel. Both are countries of great distances, whose centres of trade are fixed widely separate, whose populations are dense and full of poverty, and both are countries of unlimited natural resources yet to be developed. In each the necessity for rapid and complete railway communication is of vital import, alike for commercial as for military purposes, and while both in Russia and in India there has been laid down an extensive railway base, the fact cannot be ignored that what has already been done has proved more or less a failure. Yet never so much as now was the necessity of railway extension felt, and, urged by this necessity, the Governments of Russia and India have of late contemplated railway extension on a scale which shall make those lines already built but a small proportion of the whole, and the attention of each country has been turned to England, to learn what is the latest practice, experience has taught, before they finally commit themselves to what may be the irrevocable step of deciding upon the gauge of the future. And almost simultaneously the representatives of the Russian and of the Indian governments arrived in England for the purpose of obtaining information that might help them to a decision.

Prompter in action than the Indian Commissioners, the advisers of the Russian Executive inspected works here and in other parts of Europe, and especially basing their conclusions upon what they had witnessed on the Festiniog Railway, recommended in a report to their government the adoption of a narrow gauge for the system of second rate lines, a system involving the ultimate construction of some thousands of miles, and extending over the whole country. The adoption of narrow gauge railways in Russia may therefore be regarded as an accomplished fact. With India, however, the case is widely different; not only does the character of her administration prohibit any prompt or autocratic action, but probably a greater amount of caution in taking any initiative step fraught with consequences so serious, dictates unusual care in coming to a conclusion. The opinions, however, of the engineers employed to discuss the question now point to a conclusion, not harmonious, it must be observed, but differing to the extent of 9 in., Messrs. Strachey, Dickens and Rendel advocating a gauge of 2 ft. 9 in., and Mr. John Fowler recommending a width of 3 ft. 6.

All parties, however, concerned in advising the Government, agree apparently in the necessity of adopting a change in the existing railway gauge of India; in effect, of the necessity of inaugurating a new railway era in a country where over sixty millions sterling have been expended in the construction of 5,000 miles of line, and of inverting the experience and the practice of the last quarter of a century. The practicability of retaining the present gauge in future extensions has been, we believe, but scantily discussed, it being regarded as a necessity that the radical change, unavoidable in future construction, shall commence with the formation width.

Yet we think that the advocates of the broad gauge might adduce some strong arguments in favor of retaining the present standard, and while the mistakes that have been already committed cannot be ignored or denied, it would be very possible to show that cheap railway construction is to a great extent independent of gauge.

It may be worth while to recall the circumstances which led to the adoption of the present gauge of the Indian railways.

In 1842, when Mr. Macdonald Stephenson first advocated the introduction of railways into India, and after due delay interested the East India Company in the project, the ordinary established English gauge was looked upon as that best suited for the new railways. But after the East India Company had sent out to India, as their engineer, Mr. Simms, the report and recommendation of that gentleman modified the views previously entertained. Mr. Simms entertaining broad gauge ideas, yet scarcely lending himself to the extreme doctrines of Brunel, committed himself to what appeared a safe and medium course, believing that by taking the average between the narrow and the broad English gauges the happy mean would be reached. In putting forward this recommendation, Mr. Simms was, it would appear, actuated by caution, and a desire of originality, but at the present time it is difficult to understand by what process of reasoning he could have arrived at the width he recommended as the best. The standard English gauge was derived, it is true, from the dark ages of tramway engineering, yet it had all to recommend it, for it afforded a maximum width, with reasonable economy of construction, while the Great Western Railway, built by Brunel for monumental rather than industrial ends, could scarcely have served as a standard by which to measure the width of the Indian gauge. It is, moreover, difficult to understand why, with the favorable and sufficient experience of the English railways, whose traffic had then become largely developed, a wider gauge could have been advocated for India, where trade had yet to be created, where distances were so great, and in which it was obvious that the time must come when a great network must spread itself over the country. But this mistake of gauge was not the only one that was committed in the outset. It was attempted, though, fortunately, the attempt failed, that not only the gauge, but the dimensions of all parts of the railways and the rolling stock should be made to prescribed dimensions, that no departure from the rules then laid down should be made. More shortsighted policy than this it would be difficult to conceive, for it would have tended effectually to check progress or improvement, and to hold back the Indian railways of the future in the same condition as when they were planned out by the imperfect experience of 1845. Due allowance, however, must be made for the fact that experience then was so imperfect, and notions as to the future railway requirements of India only limited.

It is enough that the advice as to gauge given to the East India Company was unfortunately adopted, and that through a series of years, a costly not to say an extravagant executive, constructed the system of Indian railways at an outlay vastly exceeding Mr. Simm's original estimates. The costly school of English railway engineers was outdone in India. The co-operation of the East India Company encouraged lavish outlay, and money flowed in for the formation of lines guaranteed by the government. It is not to be wondered at, therefore, that in the early days of Indian railways so much capital was uselessly sunk. An expensive home management designed works almost regardless of cost, which were carried out faithfully by their representatives abroad, and when the Honorable East India Company were compelled to yield up their trust, and hand the reins of management to the Government, matters were not improved. The Public Works Department of India has, to say the least, failed to fulfil its duties with satisfaction, and certainly with economy, and the recent appointment of engineers unqualified save by interest and position are, it has been lately alleged, amongst the grave inconsistencies committed by the body in whose hands lies the railway future of India.

The unfavorable circumstances, therefore, under which Indian railways were commenced, and have been continued, may be easily conceived. An error in judgment, committed in the outset, was perpetrated extravagantly in the ensuing years, and obstructive legislation has further contributed to the evils originated by want of experience.

Two conclusions have, however, been definitely arrived at by the Indian Government; the country must possess more railroads—9,000 or 10,000 miles of line must be built before the system can in any way be complete, and these lines built by the State, for the most part, must be made upon a model widely different from the existing one. From Kurrachee along the Indus Valley over 1,000 miles are required to join Bombay with Kurrachee. Nearly double that distance will be laid down for the central Indian system to open up a vast and profitable district joining Delhi with Baroda, and placing important towns, now isalated, into railway communication. The Bengal system has now a mileage of 943 miles, and 1,200 miles will be added to complete it. The coast line between Calcutta and Madras, with all its numerous branches, would be 1,100 miles in length, and 1,000 miles will be required in the Deccan. Five hundred miles of branches are recommended for the Great Indian Peninsula Railway, 300 miles for the Bombay & Baroda; while a large number of minor railways, and the rudiments of a system in Burmah make up the total already sketched out for the extension of the Indian railway network.

But the great total of 15,000 miles is far from representing the ultimate extent of railways in India. Six thousand miles have already been completed, or are in progress, and 9,000 are recommended for construction by the Government as speedily as possible, but before these are half built, new necessities will arise, and branches and extensions of the present lines will become inevitable, whilst independent railways will be required, and probably a secondary network will be unavoidable.

With a thorough knowledge then of the mistakes that have already been made, and a fair appreciation of the immediate and increasing railway requirements of India, it behooves those to whom the management of the State railways is entrusted to consider well, and to act cautiously in the reform they are at present contemplating.

The result to be attained is to build railways at the lowest possible cost, which shall develop the greatest possible amount of usefulness, and to reach this end something more than mere cheapness is to be considered. It is not with India, as it has been with the United States, or as it is to-day with some other of our colonists. In the former country, limited means had perforce to accomplish great things, to spread itself over wide distances, and to construct the way—a rough and imperfect way it may be—that should serve the turn, till its usefulness had produced the means wherewith to make a stronger and a more permanent road. In America, then, it was and still is in some cases, the question between cheap railways or none, and in some of our colonies the same alternative exists; the difference of £1,000 a mile makes a railway possible or impossible, and in such colonies the gauge question presents no difficulties, for a narrow width is the first economy to be made without hesitation, and one upon which great subsequent savings depend.

In the United States, the gauge question is practically settled, and the numerous gauges are being rapidly reduced to the 4 ft. 8½ in. standard, and American railway engineers, not having been trained in Westminster, if they lack strict professional training, have, at least, practical instincts that lead them in the most direct line to the end in view, while at the same time necessity enforces conditions which would probably be otherwise disregarded. In our colonies, as we all know, matters are very different, the etiquette of Great George street rules in the bush, and the shadows of Westminster fall over the downs and hillsides of Tasmania. Our reputation for strength, solidity and durability must not be called in question, and hence we see erected in Victoria iron bridges which the English manufacturers hesitated to make, they were so heavy, and stately stations where timber sheds ought to have been.

So keenly alive was the Public Works Department of India to the superior capability of American engineers to construct cheap railways, that one was recently imported from the United States, with what success we have not learned, but can imagine; probably, the only good result obtained from the transaction was to show that the department was dissatisfied with its own system of working, and that it had an earnest desire to do better.

But while the plea of poverty cannot be put forward by the Indian Government nor the prospects of a very limited traffic in the future be urged as a reason why the new railway system should be constructed in the cheapest possible manner, the vast extent of country which the new lines must traverse, and the numerous branch railroads that will be required, making altogether a total, as we have seen, of 9,000 miles already contemplated, and probably twice that length before the system will be complete—this magnitude of the work places India in the same position with regard to her future railway construction as her poorer colonial sisters, and a due consideration of the facts has led her professional advisers to recommend a narrower gauge than that already existing, the opinions differing between 2 ft. 9 in. and 3 ft. 6 in.

There is no wonder that in the face of this comtemplated reform, the proposed alteration of the formation width, and the adoption of a new standard have already met, and will still encounter, strong opposition. All the evils attendant upon a break of gauge are urged against a change, especially by those engineers whose prejudices, or conservative views, cannot accommodate themselves to the onward march of improvement.

But if it should be proved by the experience of the next few years, and doubtless it will be so proved, that, apart from the saving involved in first construction, the cost of maintenance and working should be considerably reduced, and the narrower guage be found of ample capacity, then the break of gauge will be a matter of small importance, for the wider must inevitably be swallowed up by the narrower, just as the Great Western Railway has had to be reduced to the standard gauge of this country. The transition state would cost much, and extend over a series of years, but gradually it would be effected, and the rolling stock as gradually changed, while the formation width of the broader gauge could be made available, with comparatively small expense, for an extra line of rails of the lesser width. It is, however, contemplated, we believe, that the 5ft. 6in. gauge shall be maintained as long as possible in its integrity, and the lighter railways be made independent of those already built; whilst the necessary branches and extensions required to complete the present railways should also be finished, not perhaps upon the existing model, but of the same width, though of far lighter construction, provided with a special rolling stock adapted for the comparatively slight nature of the road. We believe that this would be extremely false policy. India can have ultimately but one railway gauge, exclusive, of course, of exceptionally narrow lines, of the Festiniog Railway type, which it may be found expedient to construct for special purposes. But the iron high roads must be all of one width, and we believe that 3ft. 6in. will be the width decided upon.

We do not know by what train of thought Messrs. Strachey, Dickens, and Rendel have arrived at 2 ft. 9 in. for the future Indian gauge. Such a width appears to us to combine all the disadvantages of the narrow gauge, and but few of the advantages. The saving effected in first construction would be utterly disproportioned to the reduced measure of usefulness, and such lines would be entirely insufficient to deal with the accumulating traffic of the trunk railways. It must not be forgotten that the maximum amount of traffic fixes the gauge of the whole system, and that no sacrifice can be made at the expense of crowded districts, in favor of those sections running through an unproductive country. Besides, it is not for the present but for the future that we are deciding the question, and he must be a bold prophet who assigns a limit to the ultimate duty the new system will have to perform. It is only consistent, therefore, with the plainest common sense to allow a sufficient margin for the increasing traffic the coming development of India will create. And unless some very urgent reason could be advanced for adopting extremely narrow gauges, it appears to us that 3 ft. 6 in. is the least that should be sanctioned. Some such reason *may* be found for a slight modification of this dimension, and a gauge might well be decided upon which would utilise to the utmost the formation widths of the existing 6,000 miles of railway in case experience shall warrant the sweeping away of the present standard gauges.

At all events, for the present the change must necessarily be only an experimental one to a large extent, and a short experience would decide the question definitely. It is useless to point out existing cases—to quote the Festiniog, the Norwegian, the Queenstown railways as examples which definitely settle the problem. The first is entirely exceptional in its character, admirably adapted for its work, and useful to show what can be done on an extremely narrow base; the Norwegian system teaches us more, but the practice and requirements which have developed those lines may be lacking in the broader colonial fields; while the Queensland railways can hardly be considered a success, unless compared with the neighboring failures of Victoria. To decide definitely now would appear to us as great an error in judgment as that which 25 years ago led to the undesirable state of railway affairs at present ruling in India, while on the other hand a practical experiment would suffice to settle the question.

That ultimate success would attend the change, we have no doubt, but we trust the extreme view at present held by the majority of the Indian Government advisers will be modified. We consider that 3 ft. 6 in. is the narrowest gauge that should be adopted, but, as we have said, the existence of so great a length of railways has to be taken into consideration, and the adaptation of their existing works may modify the width decided upon.

The question of gauge, however, is only one of many arising in connection with the new system. Economy in construction through every detail can alone produce cheap railways, the narrow base affording special facil-

ities to the engineer for reducing his estimates. And other and important reforms will remain to be made in the Public Works Department after the gauge discussion is ended. The present system of carrying out works is totally opposed to economy. Perhaps, indeed, it is not too much to say that, under more favorable circumstances, 5 ft. 6 in. lines might be constructed as cheaply as the proposed ones of 3 ft. 6 in., for the present departmental administration is fatal to cheap work. So, then, there remains yet another important problem to be solved, after the new battle of the gauges has been fought out, and to this Colonel Strachey should address himself.

We have not space here to enter into any comparison of the rolling stock of the two gauges, and must reserve that consideration for a future occasion, contenting ourselves with remarking here that we believe mistaken and too sanguine views are held with regard to the facilities afforded by the smaller gauge for the construction of extremely light stock. So far as the experience of the Norwegian and Queensland railways extend, we find that the rolling stock is heavier in proportion than that employed upon our standard English lines, yet their carriages and wagons were built with all possible care and judgment, and with the desire to keep down their weight. It is after all a question of speed and not of gauge, and while the lesser width reduces the weight in proportion as the accommodation is reduced, the speeds upon narrow-gauge lines must be reduced also, if extremely light stock is to be employed. And this remark applies equally to all lines, whether their rails are placed 5 ft. 6 in. or 2 ft. 9 in. apart.—*Engineering.*

Evans versus Fairlie Again.

We give below a copy of a letter addressed by Mr. W. W. Evans to the editor of *Engineering* under date of October 19. It will serve as a sequel to Mr. Evans' paper on the Fairlie Engine, which was read before the Master Mechanics' Association, and which we published last week:

For the past four years I have noticed in the columns of your valuable paper, and in other papers, long articles on what is called the "Fairlie Engine." I have received pamphlets and accounts of trials of the "Fairlie Engine," and I have seen evidence enough to prove, as far as mere statements can prove a thing, that this so-called Fairlie Engine is a big wonder, and that its merits, if it has any, are being pushed by a man of energy and activity, who has by this time probably brought it to as near perfection as it is capable of being brought. Having for years been deeply interested in mountain railways, where steep gradients and numerous sharp curves became a necessity in climbing to summits of great elevation, I naturally studied all the mechanical contrivances and inventions applied to locomotives to overcome these difficulties. It became a necessity, long years ago, in the railway practice of the United States, to have locomotives and cars also that would traverse sharp curves and steep gradients on mountain sides, during the storms and frosts of winter, when all irregularities of track were held as in a giant's vice and irreparable; also during the spring, when this giant's grip was loosened, and mud took the place of adamantine hardness; and to do this with speed and safety, that was the problem to be solved, and it was solved by the adoption of a swiveling truck under the forward part of the locomotive, which was called a bogie, after a two-wheeled vehicle of that name used in the streets of Newcastle, in England. This was done at the recommendation of George Stephenson, he having proposed it to Robert L. Stephens, of the United States, in 1832. After listening to the difficulties we must face in adopting railways in this country, I received this information as to the origin of the name, and the first introduction of the bogie in railway practice, from Mr. Robert Stephenson, in London, in 1853. I cannot refrain from here expressing my belief that had George Stephenson lived a few years longer, with the influence, and wonderful mechanical instinct, that rare gift which he possessed in such abundance, the great merits of the bogie system would have been acknowledged and adopted throughout the whole United Kingdom, as well as in the United States. And it may possibly have been the case that one or more of your rulers would have opened their eyes to the fact that England owed a dukedom to George Stephenson more than she ever owed it to any other mortal. The bogie was adopted in this country; it had an English origin, but here is its home; here it has been petted, and nursed, and twisted, and turned, and made to do all manner of things, in running around corners of streets and making itself feel at home everywhere, on 50,000 miles of track, good track (if you will allow we have such a thing) and bad track, rough track, and smooth track, up hill and down hill, over the mud of spring and the frost of winter, through rain storms and snow storms, over mountains and under mountains, from ocean to ocean, in almost endless forests, over trackless bogs and rolling prairies, where ballast is unknown and unattainable. In the dreary North and the sunny South, there is not a minute in the day or night "when the voice of the bogie is not heard in the land" (*I mean the meritorious, pecuniary, dividend-making, railsaving, "voice"*), as it carries above it the eagle eye of the engine driver and the life of the sleeping passenger, as thousands on thousands of them are whirled through space in safety, as far as the bogie is responsible. We claim the bogie as ours; we love it, place our faith in it, and defy any other people to make it do more for them than it has done for us. When Mr. Fairlie took up the long exploded idea of a double bogie engine to work sharp curves and climb mountainous gradients, he jumped out of a groove, in which he had seen only the stereotyped model engine which your paper in October, 1868, very wittily termed a six-footed beast. He did not know that such engines on our roads would ruin us in a year; he did not know what wonders we had made the bogie perform in its dress of late years, of radial bars, swing-links, and equalizing levers fore and aft, and crossways; and what is more, he did not, would not, and could not see it when he came here. Although it was shown to him by the most extensive engine builder in this country, he insisted that what he saw was not so. If Mr. Fairlie had seen things as they were, and not as he wished them to be; if he had possessed a portion of the mechanical instinct that made George Stephenson's name a pride throughout the engineering world, he would have returned to England (as an English engineer said to me a short time since) a wiser man, for he could have seen on many railroads in the United States that American engineers have done with the single bogie, and its various mechanical appliances, more than he has ever done, or ever can do, with his double bogie engine; he could have saved himself much trouble, waste of precious time, and anxiety of mind, over an invention which is condemned by the leading locomotive engineers of the world, and particularly the engineers of England, and he would probably have saved some railway companies considerable sums of money. Having said so much, and intending to say more, in the way of criticism, and in the face of the opinion of the great London *Times*, and the certificates of dukes and counts, that this so-called Fairlie engine is a wonder, I will add that when Mr. Fairlie can show me on mountain grades and sharp curves as much work done in proportion to weight on drivers, and at the same cost, as I can show done by American engines, I will become a convert, adopt his system, and give him the entire benefit of it, if he can prove to me that any part of it had its origin in his brain.

Wishing to know the comparative merits of the so-called Fairlie and the American bogie engine, I have, thinking that figures put down in all honesty would not lie, taken trials of two of the Fairlie engines as printed by himself, and vouched for by a duke, a count, and other railway experts, and put them by the side of trials of engines built under my direction, and experimented with one in Chili by order of that Government, and one in Peru by order of that Government, both trials being witnessed by English engineers. I send you a copy of this table of comparisons; it speaks for itself. I have brought the whole four trials down, as near as it can be done, to one standard, which you will find at the bottom. It is "foot-pounds" of work done in lifting train alone, exclusive of engine, per hour, per ton of weight on drivers, calculated from weight of train, speed per hour, and elevation overcome.

I beg now that you will let me, in your columns, ask a few questions:

1st. How came Mr. Fairlie to give his name to this engine?

2d. Is not this so-called Fairlie engine identical in all its chief features with the "Seraing," a four-cylinder, double bogie engine, built by the Cockerells at Seraing, in Belgium, about eighteen years ago, to compete for the prizes offered in Austria for engines to run on the Semmering Incline in the Noric Alps, and described and illustrated in Herr Eugerth's work on locomotives, published about sixteen years ago, and also described and illustrated in *Engineering*, vol. i, page 84?

3d. Was not this engine, the "Seraing," a failure; and were not all the other engines, the Bavaria, the Neustadt, and Vindeboua, failures, as none of them were adopted, although two of them beat the Seraing at those trials, the Bavaria taking the prize of 20,000 ducats?

4th. Did not Jean Jacquier, of Mulhouse, and Petit, of the Great Northern of France, design and build, long years ago, engines with four cylinders, and double bogies, or something very much like them?

5th. Were not the engines built on the so-called Fairlie system by Cross of St. Helens, and sent to the Queensland Railway by order of Sir Chas. Fox & Sons, failures? Mr. Jetter's report on these engines, to be found in your Journal, Vol. viii., page 262, says: "The "one engine that was placed under steam refused to "run round five chain curves, and after distorting the "gauge, with infinite local damage to the road, and "some damage to itself, it became helpless, and had "to be towed back to the shed."

6th. What is the true weight of the engine "Progress" in steam with water and fuel? In the pamphlet called "Opinions of the Press," published by Mr. Fairlie, the weight is put down on page 1 as 40 tons, on page 2 as 44 tons. In the pamphlet of trials of this engine in February last, it is put down as 54 tons. Mr. Colburn told me he had weighed this engine and found it to weigh over 60 English tons.

7th. Taking the weight of this engine as corrected, from 44 tons to 54 tons, the weight I have used in the table of comparisons, it gives 6¾ tons on each driving wheel. Does Mr. Fairlie consider this a fair weight on a single wheel?

8th. In an autograph letter of Mr. Fairlie's now before me, he says, speaking of his engines: "Rails will "last under such engines, just three times as long as "with ordinary tank engines."

I would ask what data Mr. Fairlie possesses which allows of his using the words "just three times as long?" Three times is a big figure. What can he mean? Is it a fact, or a mere figure of speeech? Does he mean that an engine with 6¾ tons on every wheel, and probably more; in trucks that have to be tied, and braced, and buffed in the strongest manner to keep them from kicking themselves to death, will run easier, and make the rails complain only one-third as much as they would when subjected to the smooth motion of an American bogie engine having only 4¼ tons on a wheel? Such engines look and act as if they would entice the rails to last forever, not only "just three times as long."

9th. In the letter alluded to, Mr. Fairlie asks that breathing places be arranged in the location of a railway in Peru, if his engines are ordered to run it. Is this customary on your mountain railways to have breathing places in the steep inclines? It is new to me. I like it immensely. "A merciful man is merciful to a dumb beast."

10th. Where were all the first-class mechanical engineers and locomotive engineers of England when these trials took place before the Duke of Sutherland and others interested in railways? I cannot find that any one of them was present. I hear that there is not one of them that believes in or will pin his faith on the double engine. Can this be so? Do they all shake their heads, as Mr. Fairlie says one did to him—one he thinks would be a "tremendous gun on his side," if he could only convert him.

11th. In calculating resistances to overcome, Mr. Fairlie calls car frictions ten pounds per ton. Is this the real or imaginary frictions of English cars? I use five pounds in calculations, and have to screw my courage up immensely to get down as big a figure as that.

12th. Can you give us the cost of these double engines? The papers and pamphlets tell us a great deal about these engines, but don't say a word about the cost. Do they cost as much as two engines, and last "just three times as long" as one?

13th. If these double bogies kick, is there any law to prevent them, and render them quiet under difficult circumstances?

14th. In comparing engine trials, is not foot-pounds of work done in lifting train alone per hour, per ton of weight on driving wheels, a fair method?

15th. Mr. Fairlie has an engine, the "Tarapaca," on the way out to the Iqueque Railway, a road in Peru, having very steep inclines and sharp curves. There are two American engines on that railway, built under my direction. Would Mr. Fairlie, just for the fun of the thing, like to risk a few hundred pounds on the comparative powers and performance of these engines with his on the same road, with the same water and fuel, the measure of power to be foot-pounds of work done in lifting train alone per hour, per ton of weight on driving wheels, calculated from weight of train, speed per hour and elevation overcome; the trial to be made on the first five, or eight, or ten miles of the railway, or the whole line, as Mr. Fairlie may select; the trial to take place only when both engines are declared to be in perfect order by the agents of both parties; the stake to be whatever Mr. Fairlie may name. If he is agreeable to such a trial and will offer a challenge, he shall not have to look long for some on to take it up. We belong to a race that delight in trials of horses' powers, and I see no reason why it is not good sport to try engines' powers and speed.

The Sheffield Scientific School.

We mentioned some days ago that Professor Wm. P. Trowbridge, lately of the Novelty Iron Works in New York, had joined the corps of scientific professors in the Sheffield School of Science in New Haven, as professor of mechanical engineering. Partly to introduce him to the manufactories, which are as varied and extensive in Connecticut as in any part of the country, and partly to make this school of pure and applied science known to the people of the State, a committee of the faculty are now making a tour of the principal places, holding informal public conferences with the leading men, and explaining the relations of science to the progress of the industrial arts and the welfare of the community. Within the present month meetings have been held in New Britain, Norwich, Waterbury, Birmingham, Bridgeport, Litchfield, Woodstock and Danielsonville, and several other appointments have already been made for other towns. These meetings have been held under very different circumstances, now in a parlor, now in the court house, now in a church, now in a city hall, and so on, the assemblies being commonly of men only, but sometimes the whole community turning out to hear the story.

It is surprising to see how much interest is awakened by this pilgrimage. The Bridgeport *Standard* of Tuesday last fills a column with a report of the meeting held the evening previous, and adds an announcement that the next day a volunteer deputation of the citizens of Bridgeport will go to New Haven on Wednesday to inspect the working of the school. Similar evidences of interest are exhibited in other places. The net result appears to be an increasing appreciation of the value of science as an element in the higher education, and as an influence upon the progress of society; while its power in promoting the love of truth for its own sake is clearly and forcibly illustrated.

The Sheffield school commences the year with a new and enlarged programme of studies. The most noteworthy changes are to be found in the increased prominence given to mechanical or dynamical engineering, under the guidance of Professor Trowbridge; the arrangements which are made with the Yale School of the Fine Arts, under Professor John F. Weir, for instruction in elementary and free hand drawing, and the course of instruction proposed for young men who are desirous of fitting themselves for the pursuit of medical studies. The chemical laboratory and the engineering classes are well attended, the freshman class numbers thirty-seven scholars, there are twenty-five graduates following advanced courses of study, and the whole number of scholars is one hundred and twenty-three.—*New York Evening Post, 1st.*

—Mr. Henry Bergh, President of the American Society for the Prevention of Cruelty to Animals, has written a letter to the New York *Times* in which he highly extols John W. Street's patent cattle car, saying he is convinced that "it obviates all the difficulties heretofore existing."

—Last Monday some person unknown entered the room of James F. Joy, of Detroit, at the St. Nicholas Hotel, N. Y., and stole therefrom bonds of the Chicago & Iowa Railroad of Illinois, to the value of $50,000.

General Railroad News.

LOCOMOTIVE STATISTICS.

Allegheny Valley.

Mr. G. W. Glass, Master Machinist of the company, reports for the month of September, 1870:

The number of miles run by trains was as follows:

Passenger trains	30,800
Freight "	52,666
Ballasting, &c.	6,440
Total	89,906

The cost per mile run was:

For repairs	5.22 cts.
" fuel	4.53 "
" stores	.83 "
" engineers, firemen and wipers	7.60 "
Total cost per mile run	18.17 cts.

Average number of miles run to

Pint of oil	25.62
Ton of coal	37.46

Thirty-five locomotives made mileage during the month. One new locomotive is building. The length of the road is 132 miles.

Illinois Central.

The report of S. J. Hayes, Superintendent of Machinery, for the month of August, 1870, affords the following:

Passenger trains	109,867
Freight	292,471
Construction	8,5 6
Switching	48,119
Total	458,963

The cost per mile run was:

For oil and waste	.77 cts.
For fuel	6.62 "
For engineers and firemen	5.92 "
For cleaning	1.06 "
For repairs	10.35 "
Total	24.63 cts.

Cost per mile run, in cents:

Passenger engines	18.09 cts.
Freight engines	26.42 "
Construction engines	15.02 "
Switching engines	21.66 "

Average number of miles run to

Pint of oil	13.78
Ton of coal	37.87

The above oil includes that used in headlights and in lamps of engineers. Wood is rated at $6.50 per cord, coal at $2.25 per ton, in Illinois, and at $2.50 on Iowa Division; oil, 65c. per gallon; waste, 15c. per pound. Rebuilding, superintending, teaming and all other expenditures appertaining to repairs are included in the above cost of performance of locomotives.

The whole number of locomotives owned by the company is 184, all but two coal burners. The length of the road operated is 939 miles. 14 are undergoing repairs and 5 have had general repairs during the month.

Louisville, Cincinnati & Lexington.

Mr. William Mahl, Auditor of the company, sends the following statement showing the cost per mile for locomotive service for the quarter ending September 30, 1870:

Repairs, ordinary	3.44	
" due to accidents	.71	
		4.15 cts.
Engineering and firing		7.16 "
Watching and cleaning		1.05 "
Oil and tallow		.80 "
Waste and rags		.34 "
Fuel, wood	10.67	
" , coal	9.18	
		9.80 "
Water supply		.99 "
Total		24.19 cts.

The company operate the line from Louisville to Cincinnati, 107 miles, and from Louisville to Lexington, 94 miles.

OLD AND NEW ROADS.

Knox & Lincoln.

The heavy rock excavation on this line, at Woolwich, Maine, is now completed, and the work of laying rails has begun. This cut is probably the deepest and most extensive in Maine, 22,000 yards of solid rock and 30,000 yards of earth having been taken out. The grading of the road is now nearly completed; the work on the bridge is advancing rapidly. The road will be opened to Wiscassett in a few weeks.

Chicago, Pekin & Southwestern.

The grading between Pekin and Washington is completed. From the latter point to the county line, 3½ miles, the work will be finished in about ten days. The right of way through Woodford county, about which there has been considerable quibbling and cross-firing, is secured, or will be in a short time, so that the work of grading is not retarded in that county, and will be completed in twenty days. Beyond Minonk, on the Woodford and Livingston county line, the road is graded, bridged and tied to Marseilles. From the latter point to Chicago, sixty miles, about twenty-five miles of the grading is finished and the work is going on flatteringly—it being the intention of the contractors to complete the grading between the two points last named by the 15th of January next. The number of teams employed along the line up to the close of last week was between four and five hundred, and is the intention of the contractors to double this number within the next two weeks, should the weather continue favorable.—*Pekin Republican.*

We learn from the El Paso *Journal* that a large gang of men and teams have been engaged for two weeks building the roadbed northeast of Eureka, while another large gang are working west of town. The track will cross the Toledo, Peoria & Warsaw Railway a few rods east of the east end of the switch at Eureka, will pass close along the south side of the station house, and pass west just north of the west mill, and so on a little south of Cruger, to Washington. East of Eureka it curves north, and enters Roanoke township. The grading is nearly done between Eureka and Washington, and will be finished in a few days to the Roanoke township line. Thence it takes a northeasterly direction through Roanoke and Clayton and Minonk.

Springfield & Illinois Southeastern.

One thousand tons of iron have arrived in Chicago for the western extension of this road from Springfield to Beardstown.

Plymouth, Kankakee & Pacific Consolidation.

The directors of the Kankakee & Illinois River, and the Plymouth, Kankakee & Pacific railroad companies met in Chicago on the 25th ultimo and effected a consolidation.

The articles provided that the present directors of both companies shall act as the board of the consolidated company *ad interim* and that they shall call a meeting of the stockholders to elect a new board ninety days from date.

The following *ad interim* officers were elected:

James McGrew, of Kankakee, President; C. H. Reeves, of Plymouth, Vice-President; J. C. Cushman, of Plymouth, Secretary; S. N. Hathaway, of Kankakee, Treasurer.

The Illinois directors are: James McGrew, of Kankakee, Azariah Buck, of Pilot, W. F. Singleton of Momence, J. G. Strong and H. A. Gardner, of Dwight, E. Evans, of Streator, Wm. Eddy, of Hennepin, Joel Hopkins, of Putnam county.

The Indiana directors are: C. H. Reeves and J. C. Cushman, of Plymouth, G. W. Cass, of Pittsburgh, and S. F. Hanna, of Fort Wayne.

The salary of the President was fixed at five thousand dollars per annum; that of the Secretary at two thousand dollars, and that of the Treasurer at two thousand dollars. Provision was also made for the payment of the directors and other officers of the company, after which the meeting adjourned *sine die.*

Rockford, Rock Island & St. Louis.

The Burlington *Hawk-Eye* learns from Mr. Cruger, Vice-President of the Toledo, Peoria & Warsaw Railway Company, that the branch connecting that road and the Rockford, Rock Island & St. Louis road, with Burlington is to be built immediately. The iron is already in hand. It is expected that an arrangement will be made by which these two companies will use eight miles of the track of the Carthage & Burlington road next to the bridge.

California & Oregon.

According to the San Francisco *Call*, "the entire force of laborers on the Stockton & Visalia Railroad with their carts, horses and implements, have been transferred to the California & Oregon road, work on which is to be prosecuted vigorously. The managers intend to reach Red Bluff with the track this winter, if it is a possible thing. For the present, the Stockton & Visalia road will terminate at the Tuolumne river."

Memphis & Little Rock.

Mr. Greenlaw, who has charge of the building of the road, announces his intention of completing it before 1871. The Memphis *Avalanche* says: "At the present time the road is completed from Hopefield to Brinkley and from Little Rock to DuVall's Bluff. There remains only about thirteen miles to build between Brinkley and the Bluff, together with the bridge over White River, opposite the Bluff. This bridge, which will be of iron, with a 'draw' to allow steamers to pass up and down the river, is in course of erection in Louisville, and is nearly completed."

Marietta & Pittsburgh.

The Secretary sends us a map of this road and its connections, by which it appears that its course is from Marietta northward 60 miles to Cambridge on the Central Ohio, and thence northeastward 30 miles to Dennison, a station on the Pittsburgh, Cincinnati & St. Louis Railway 92 miles west of Pittsburgh. A line is projected from Dennison northwestward to Toledo, and one from Marietta southward through the West Virginia oil belt to Charleston. Four miles of track have been laid from Marietta northward, and the officers of the company expect to have twelve miles in operation by the end of the year. Nearly the entire line is through an extension of the Pittsburgh coal field, and a large fuel traffic is expected on the line.

Silver Lake & Angola.

A correspondent writes to us that measures are being taken to construct a line from Silver Lake, Ind., to Angola, Steuben county, where it will intersect the Fort Wayne, Jackson & Saginaw Railroad. A corps of engineers will be put in the field on the 1st prox. to survey the line to Kendallville, Noble county, at which place the line intersects the Grand Rapids & Indiana road. Our correspondent writes that from the spirit manifested by the people along the line the indications are that work will be commenced next spring.

Iowa Southwestern.

On the 1st inst. Iowa City voted aid to this line by a majority of nearly 800. The Mississippi terminus is to be at Clinton.

Burlington, Cedar Rapids & Minnesota.

The Cedar Rapids *Times* says the compaay have lately purchased 2,000 tons of iron, sufficient to complete the road from Burlington to Cedar Rapids.

The iron is being forwarded right along, and the completion of the road from Burlington to Cedar Falls by the middle of December is a fixed fact. The company has purchased five new locomotives, and will be prepared to do all the through business of the road promptly, as soon as the track reaches Cedar Rapids.

The round house at Cedar Rapids is under way. The present building will contain some ten or fifteen stalls, and will be constructed on the most approved plans, of the best material, and in the most substantial manner.

The company have recently placed on the road some new stock cars, that are very much admired by shippers. Five new engines are on the way.

In Minnesota, along the proposed route of the road, bonds have been voted by Blue Earth City, Elmore, Jo Daviess and Rome to the amount of $73,000.

Western & Atlantic.

The bill to lease this road for twenty years at $25,000 per month has passed both houses of the Georgia Legislature, and now awaits the Governor's signature.

Chicago & Southwestern.

This company have completed their road in Missouri from East Leavenworth to Plattsburg, where their trains new connect with those of the St. Louis & St. Joseph road, thus opening another route from Leavenworth to St. Louis, and at the same time affording the Chicago & Southwestern another line, by which iron can be transported to be used between Plattsburg and Cameron.

St. Louis & Fort Scott.

In the County Court of St. Louis county, on the 3d inst., the proposition to submit to the vote of the people a county subscription of one million dollars of stock in the above-named railroad was taken up, and the court refused to submit the same by a vote of three to three.

South Pacific.

It is expected that this road will be open to Neosho, near the southwest corner of Missouri, and 24 miles southwest of Baxter Springs, next week. The company have made a contract with Messrs. Ficklin & Sawyer to run a double daily line of stages between Neosho and Chetopa. The time will be eight hours from Chetopa to Neosho. From Neosho to St. Louis by rail, the time will be fifteen hours, or twenty-three hours to St. Louis. The fare from Neosho will be $20. Freight on the three classes will be reduced to 75 cents, 85 cents, and 95 cents.

The company lately asked the County Court of St. Louis county to submit the question of a subscription of $300,000 by the county, to a vote of the people, a request which the court has refused.

Missouri, Kansas & Texas.

A correspondent writes us that the trestle work over the Osage river has been carried away by the flood, whereby the work will be considerably delayed. The junction of the two branches of the road has been fixed at "Parsons," Neosho county, Kansas, a point 28 miles north of the State line, in section 17, township 31, range 20 west. It is the intention of the company to commence laying track at once from Parsons toward Fort Scott, expecting to meet the track-layers from the other direction about 25 miles northeast of Parsons.

Pekin, Lincoln & Decatur.

The Pekin *Republican* of November 4, says: "Secretary Cooleigh, of the Pekin, Lincoln & Decatur Railroad, informs us that the work of ballasting, and otherwise improving the new railway line between here and Delavan, moves forward briskly. The work on the Y at Delavan, where a junction is formed with the Jacksonville branch of the St. Louis, Alton & Chicago road, is well advanced."

Central of Iowa.

Trains are now running on the southern division of this road between Oskaloosa and Albia, 25 miles, and a large force is at work on the line between Oskaloosa and Marshalltown, which is to be completed before Christmas.

Colorado Central.

The company advertise for proposals for grading a branch line from Ralston, a point on the line now open between Denver and Golden, northeastward to Greeley. It is proposed to extend this line northeastward from Greeley to a junction with the Union Pacific at Pine Bluff, 43 miles east of Cheyenne. Work is progressing on its Western Division which it is intended to finish to Central City next year and eventually extend across the mountains to the Utah valley.

Selma, Rome & Dalton.

The lease to Mr. A. D. Breed, made in 1866, expired September 30, and the company now operate their own road. No changes are made in officers of the operating department, except that George M. Chapman, Treasurer of the company, will transact the business formerly done by James T. DeCamp, Cashier. All balances due to or from the lessee, up to September 30, should be drawn on or by Mr. DeCamp, however.

Montgomery & West Point.

This road, with its entire outfit and franchises, has been bought by the Western Railroad Company, which has for the present, its termini at Selma, Alabama, and Columbus and West Point Georgia, Mr. G. S. Foreacre, formerly connected with the Central Railroad of Georgia, is General Superintendent of the line.

Baltimore, Pittsburgh, Continental & Chicago.

The stockholders of the Baltimore & Cincinnati Company, and the stockholders of the Huntington & Chicago Railroad Company, met at Mansfield, Ohio, on the 3d inst., and consolidated the lines, under the name of the Baltimore, Pittsburgh, Continental & Chicago Railroad Company. The following named gentlemen were elected directors: T. T. Hunt, of Kenton, Ohio; David Richards, Mount Gilead, Ohio; J. M. Osborne, Belleville, Ohio; A. Waddell, Columbiana, Ohio; J. G. Chamberlain, Leetanig, Ohio; George Hardistry, Malvern, Ohio; John H. Page, Jr., Pittsburgh; Clifton Wharton, Pittsburgh; John Sludbaker, Bluffton, Ind.; John Roche, Huntington, Ind.; Wm. Sturgeon, Rochester, Ind.; Wm. Edmundorf, Knox, Ind.; T. A. E. Campbell, Valparaiso, Ind. The board organized by the election of the following officers: T. T. Hunt, President; T. A. E. Campbell, Vice-President; Geo. S. Bell, Secretary; David Richards, Treasurer. The committee of the Board of Directors of the Mansfield, Coldwater & Lake Michigan Railroad have returned from a trip over the proposed route, and report reasonable progress.

Peninsular.

A correspondent of the Detroit *Tribune* says: "President Dibble has just returned from New York, and says that iron is on the way to lay the rails from Schoolcraft to the southern line of the State. As soon as the grade is completed, rails will be laid from Climax to Brady, 12 miles, where a connection will be made with the Grand Rapids & Indiana Railroad. The distance between Brady and Schoolcraft is about six miles, where a connection will be made with the Michigan Southern. It is the intention of the company to have the road completed so as to take the members of the Legislature from Southwestern Michigan over the line at the commencement of the session in January next."

Dubuque, Belleville & Mississippi.

On the 5th inst. the Directors let the first contract on their line to Messrs. Thomas Finn, of Dubuque, and Rehling, of Bellevue. The contract embraces about four miles of grading near Bellevue. Work commences on that part of the line this week. President Graves renews the assurance that this road will be completed to its connection with the Chicago & Iowa road by the Fourth of July next.

Alabama & Chattanooga.

Trains are now running from Chattanooga to Green Pond, a distance of 169 miles, and 233 miles of road are now completed between Chattanooga and Meridian, so that in all probability the whole line will be opened for traffic in the winter of 1870–71. The eastern offices of this company have been removed from Boston to New York. Correspondence for D. N. Stanton, President, and A. F. Thayer, Secretary, will be governed accordingly.

Hamilton Cut-Off.

It is said that the Baltimore & Ohio Company is preparing to construct a railroad from Hamilton, 25 miles north of Cincinnati, southeastward about 20 miles to Loveland, a station on the Marietta & Cincinnati road 26 miles northeast of Cincinnati. This will connect the latter road with the Cincinnati & Indianapolis Junction road and reduce the distance from Indianapolis to Baltimore by this route by about 30 miles, saving also the taking of the cars into Cincinnati which are billed through.

Union Pacific.

An agent of this road was to leave San Francisco this week for Australia with a full supply of bulletin boards, circulars, posters; etc., to advertise the route by that line between Australia and England.

Great Lake and Gulf.

Governor Kirkwood, of Iowa, is endeavoring to organize a company with the above name, to build a road from Lake Superior to the Gulf of Lower California, with headquarters at Iowa City. Already Clinton, Tipton, West Liberty, Wilton, Oskaloosa, and other places are fighting for the line.

Duchess & Columbia.

On the 3d inst., at Poughkeepsie, the litigation between the Dutchess & Columbia and Boston, Hartford & Erie companies, was terminated in the Supreme Court, before Judge Barnard. After hearing the proofs, the Judge granted a decree, declaring forfeited and void both the lease and deed once held by the Hartford & Erie Railroad, and restoring the Dutchess & Columbia Railroad to the company of that name.

Terre Haute & Danville.

Track-laying on this line has been commenced at Clinton, on the west side of the Wabash.

Mendota & Prophetstown.

The Clinton *Herald* suggests that this road be extended to that place rather than any other place on the river further south. It urges that the railroads centering there are likely to attract it by the prospect of through traffic. As the two roads now entering that place are controlled by the Northwestern, no traffic could be expected from them. Until Clinton has more railroads, new Illinois lines will hardly go out of their way in order to share in its traffic.

Great Western of Canada.

This company as will be seen by a notice in our advertising columns, invite proposals for the construction of the second division of their Canada Air Line, from Aylmer to Simcoe; to be handed in to the Treasurer's office by the 25th inst. Plans and specifications can be seen at the engineers office in Hamilton.

United States Express.

This company has commenced doing business over the entire line of the Grand Rapids & Indiana Railroad, from Fort Wayne, Ind., to Paris, Mich., and also on that additional portion of the Cincinnati & Indianapolis Junction between Muncie, Ind., and Fort Wayne, Ind. Offices have been established at the following places: In Indiana—Rome City, Wolcottville, Lagrange, Lima, Bluffton and Montpelier; in Michigan—Mendon, Brady, Plumville, Wayland, Grand Rapids, Rockford, Cedar Springs, Howard City, Morley, Big Rapids and Paris.

ELECTIONS AND APPOINTMENTS.

—T. A. Morris and W. T. Boaz, Receivers of the Indianapolis, Cincinnati & Lafayette Railroad, publish an order announcing that Mr. W. H. L. Noble has been appointed General Ticket Agent of that road. All reports and communications relative to the passenger or ticket business should be addressed to him at Indianapolis, Ind.

—The stockholders of the Indianapolis, Peru & Silver Lake Railroad Company, met at Stockdale, Miami county, Indiana, on the 15th inst., pursuant to due notice, and held an election for directors, to serve for the ensuing year; when the following named gentlemen were elected: H. J. Connor, of Silver Lake, Kosciusko county, Ind.; Adam Stout, do.; Henry Eichholtz and Daniel Shoemaker, of Wabash county; Abram Yost, David Thompson, Jas. M. Brown and G. L. Dart, of Miami county; C. E. Cole, Berlin, Ottawa county, Mich. After the election the directors elected G. L. Dart, of Peru, President, and Jas. M. Brown, of Peru, Secretary and Teasurer.

—At the annual meeting of the stockholders of the Eastern Division of the Western North Carolina Railroad Company, held at Morganton on the 27th ult., Messrs. S. McD. Tate, A. Merrimon, Z. B. Vance and John McDowell were elected directors on the part of the private stockholders for the current year. The Governor and Council, appointed J. L. Henry, J. J. Mott, J. W. Bowman, W. G. Chandler, Mr. Howerton, C. J. Cowles, T. R. Caldwell and C. L. S. Corpening directors on the part of the State.

—The following appointments have been made on the Indianapolis & St. Louis Railroad: Warder Cumming, Master of Transportation, with headquarters at Mattoon; George L. Harrison, Train-Master of Western Division, with headquarters at Litchfield; J. T. Redman, Train-Master of Eastern Division, with headquarters at Indianapolis.

—W. L. Van Nest, long Southern Passenger Agent of the Louisville & Nashville Railroad, has been appointed Assistant General Passenger Agent, with headquarters at Louisville.

—J. W. Rockwell has resigned his position of Northern Passenger Agent of the Louisville & Nashville Railroad, and that office has been discontinued. The business will be transacted by Samuel B. Jones, General Agent, at No. 319, Broadway, New York.

—Larz Anderson has been elected Vice-President of the Ohio & Mississippi Railway Company in place of A. H. Lewis, deceased. Mr. Anderson is one of the most eminent citizens of Cincinnati.

—Robert Allen, formerly joint agent of the White and Red fast freight lines at Rochester, N. Y., has dissolved his connection with the White Line, and will henceforth devote all his time and influence towards promoting the business of the Red Line Transit Company. This freight line running *via* Cleveland, Toledo and Decatur to St. Louis, will prove a very powerful competitor against the White Line, which, up to the present time, has enjoyed a monopoly of traffic between St. Louis and the East, *via* Cleveland and Buffalo.—*Official Guide.*

—On the 3d inst, the stockholders of the Illinois Farmers' Railroad held a meeting in Jacksonville and elected the following directors: Marshall P. Ayers, of Jacksonville; J. B. Shiedby, of Macoupin, county; and Aug. E. Ayers of Morgan county. Subsequently the directors held a meeting, and elected Marshall P. Ayers President, and Wm. S. Hook Secretary and Treasurer of said company for the ensuing year.

—A meeting of the stockholders of the Indianapolis. Cincinnati & Lafayette Railroad, at Morris, Ind., on the 7th inst., resulted in the unanimous election of the following Board of Directors: M. E. Ingalls, Wm. P. Harris, and Thos. H. Perkins, of Boston; John S. Kennedy, Geo. Bliss, and Wm. A Booth, of New York; W. O. Rockwood, of Indianapolis; T. B. Lewis, of Lawrenceburg; and W. W. Smith, of Cincinnati. 80,797 shares were represented. The board organized by the election of M. E. Ingalls President *pro tem.*; A. Worth, Secretary. An investigation into the history and workings of the company from the beginning was ordered, and W. S. Groesbeck and Aaron F. Perry were appointed Advisory Committee, on the part of the stockholders, to aid in the investigation. Messrs. Ingalls, Harris Perkins and Rockwood are new members of the board, taking the place of T. A. Morris, of Indianapolis, (now one of the receivers); A. R. Forsyth, of Greensburg, Ind.; H. C. Lord, of Cincinnati, (late President), and Joseph S. Fay, of Boston.

MECHANICS AND ENGINEERING.

Railroad Gates.

Mr. S. P. Baker, an English inventor, proposes to arrange by the side of the line of railway a treadle bar, in such a position that a train in passing along the line shall depress the treadle, and in so doing act through suitable levers or instruments on a rod or wire passing to the gate to be locked and unlocked where it gives motion to a leading plate or bolt which in one position allows the gate to work freely, and in another locks it fast. A train then in approaching the gate comes on the treadle, and so moves the locking plate or bolt as to fasten the gate to prevent persons entering upon the line; when the train has passed the gate it acts on a second treadle, which again moves the locking plate or bolt and sets the gate free, or by a simple arrangement the gate may be unlocked after a short measured interval of time after locking.

Electro-Magnetic Signaling Apparatus.

Mr. W. Robinson, of Brooklyn, has patented an apparatus for signaling by the train while in motion any break in the main track on a line of railroad by the displacement of a switch or opening of a drawbridge. The invention includes an independent circuit-breaker and closer, and additional circuit for sounding a bell or alarm audible at the station, and displaying a signal visible to the engine-driver in advance, by the displacement of the switch or drawbridge whenever the engine or train operates a main or primary circuit-breaker and closer, but which is inoperative when the switch or drawbridge is displaced, except on approach of the train or passage of it over the primary circuit-closer, thus dispensing with waste of the chemicals used in the battery. The invention also includes an irregular spacing of the circuit-breaker for operation in connection either with an irregular spaced or ordinary circuit-closer to indicate, by the intermissions in the sounding of the alarm, the direction in which the train is traveling.

—A company has been organized at Marshaltown, for the manufacture of Street's patent cattle car on a large scale.

RAILROAD GAZETTE

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Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the Railroad Public in affording us the material for a thorough and worthy Railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Inventions.—Those who wish to make their inventions known to railroad men can have them fully described in the RAILROAD GAZETTE, *if not previously published,* FREE OF CHARGE. *They are invited to send us drawings or models and specifications. When engravings are necessary the inventor is expected to furnish his own engravings or to pay for them.*

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Engineering and Mechanics.—Mr. M. N. Forney, Mechanical Engineer, whose office is at Room 7, No. 72 Broadway, New York, has been engaged as Associate Editor of this journal in charge of these departments. He is also authorized to act as our agent

Change in Rates.—On and after the 1st of January next, the price of subscription will be four dollars per year. Until that time, subscriptions will be received for periods not exceeding one year at the old rate—three dollars per year.

☞ *Our Prospectus and Business Notices will be found on the last page.*

"THE GAUGE FOR THE RAILWAYS OF THE FUTURE."

In the GAZETTE of October 15, we reprinted a paper with the above title which was read by Mr. R. F. Fairlie, C. E., before the British Association during its recent session. Coming from the other side of the Atlantic, ballasted with so weighty a name as that of the society which gave it an audience, the paper seemed at least to be worthy of careful consideration. When, however, we find it asserted in the beginning that "a "narrow gauge is *infinitely* less costly than a broader "one," we confess to a suspicion that the writer is prone to handle adverbs somewhat carelessly; and in the next paragraph the assertion that, "it is admitted "that the proportion of non-paying to paying weight "in passenger trains is as much as 29 to 1, and in "goods trains exclusively of minerals as much as 7 to "1" excites a disposition to demur and to enquire *who* it is that "admits." The assertion is qualified, however, by the statement that "this terrible disproportion is probably due to the system of management pursued; but in a far greater degree to the gauge." This is somewhat vague, so that it is difficult to know exactly what is meant when it is asserted that the proportion of non-paying to paying weight is as 29 to 1 for passenger and 7 to 1 for freight trains. If Mr. Fairlie means that the weight of the cars *and engine*, exclusive of freight, is 29 times their carrying capacity in the one case, and 7 times in the other, there the assertion is palpably absurd, and we are at a loss to know how to reconcile the assertion with the subsequent statement that "the best wagons, in an ordinary "English narrow-gauge, do not carry as much *as twice* "their own weight."

For comparison with Mr. Fairlie's statements, let us take the weight and compare it with the carrying capacity of ordinary American passenger and freight trains on 4 ft. 8½ in. gauge roads:

4 60-seat passenger cars weigh	152,000 lbs.
1 baggage car weighs	25,000 lbs.
1 locomotive and tender weighs	100,000 lbs.
Total	277,000 lbs.

This train, if the cars are filled, will carry 240 passengers, whose aggregate weight, estimating at 140 lbs. each, will be 33,600 lbs., or 8¼ lbs. of dead to 1 lb. of paying weight, instead of 29 to 1. An ordinary American "house" or covered freight car weighs from 16,000 to 20,000 lbs., and an average train consists of about:

25 cars, which weigh	500,000 lbs.
1 engine and tender	105,000 lbs.
Total	605,000 lbs

These cars usually have the capacity to carry a load about equal to their own weight, making the total amount of freight per train 500,000 lbs., or about 1¼ lbs. of dead to 1 of paying weight, instead of 7 to 1, as assumed by Mr. Fairlie. We have no reliable data at hand of the weight of English "wagons" and engines, but certainly Mr. Fairlie's statements must either be very far from the facts, or else English engineers could study to advantage the construction of American rolling stock.

If it were not for the great distinctness with which he speaks, we would feel disposed to think that we must have misunderstood his meaning when he says: "The "dead weight of trains conveying either passengers or "goods is in direct proportion to the gauge on which "they run; or, in other words, the proportion of non-"paying to paying weight (as far as this is independent "of management) is increased exactly as the rails "are farther apart." It seems impossible to mistake such language. That such an assertion should come from an engineer whose name is now heard perhaps as often as that of any other man in the profession in England, seems truly amazing. It recalls an anecdote told of "a railroad "man" in this country who stated that a locomotive he had designed would draw on a grade of 80 feet per mile 20 cars, and therefore it would take half that number up an incline of 160 feet. A shrewd listener inquired, "if that is so, how many cars can your engine pull up a perpendicular?" Now we are disposed to ask the author of the paper under consideration, if "the proportion of non-paying to paying weight is increased exactly—or in direct proportion—as the rails are further apart," what amount of dead weight would there be if the cars ran on a single rail, like a velocipede, as has been proposed? Logically they ought not to weigh anything.

The reason given by Mr. Fairlie for his assertions is, "because a ton of materials disposed upon a narrow "gauge is stronger, as regards its carrying power, than "the same weight when spread out over a wider basis." That a long axle is as light as a shorter one of the same strength, it would of course be folly to assert, and possibly wheels should be heavier on a wide than on a narrow gauge, with the same curves in each; because the slip and consequent strain of the wheels in one case would be greater than in the other.* It is not easy to see, however, how, on a narrow gauge, the body of the car could be made lighter and do the same service that it does on a road with the rails farther apart. The strains to which it is subject are, the capacity to support the load it carries and the concussion of the engine and train, both of which are independent of the gauge. It is true that the bodies of cars for wide gauge roads are usually made wider and longer, but there is no reason why they might not be made as narrow or as short as these on roads of the most contracted gauge. The only part of a car which can be reduced in weight by narrowing the gauge is the "running gear," *i. e.*, the axles, possibly to a very limited extent the wheels, and what in this country we call the truck frames.† The brakes, with the exception of the "brake beams," must be just as heavy on a wide as on a narrow gauge. So with the springs and their attachments. Now the parts where weight is affected by the gauge can be reduced, because they act in the capacity of beams supported by the rails. But they are also subject to strains of concussion, tension and compression, which are in no way attributable to their office of supporting beams, and would be just as great on narrow as on wide gauge roads.

Mr. Fairlie cites the case of the much praised Festiniog Railway with its gauge of 1 ft. 11½ in. "The "wagons used upon it for carrying timber, weigh only "twelve cwt., and they frequently carry a load of over "3½ tons at a speed of twelve miles an hour. In "other words, these wagons carry as much as six times "their own weight." It is a little strange that timber wagons should have been selected for this illustration and no description given of them, because it is not an unusual thing to see timber loaded on two trucks, one under each end, and without any connection with each other, excepting the timber itself. We believe we are not mistaken when we say that it is the only material which can be thus loaded for transportation. As no car body is required to sustain the load, obviously not only will the weight of the car be very little, but the amount of freight carried in this way may be equal to the maximum capacity of any ordinary car plus the weight of a car body. Surely what purports to be a scientific paper should be more exact in its detail of "phenomena," especially when, as in this case, they form the base or premises on which the whole argument rests. Besides, an isolated case like that of the weight of cars for the transportation of a single article, on an exceptional road, is hardly sufficient ground on which to build an argument of so sweeping a character as that contained in Mr. Fairlie's paper.

That all our 4 ft. 8½ in. gauge roads are carrying too much non-paying weight we are ready to admit, but the reasons for it are attributable to other causes, and not to the width of the gauge. That for some special purposes very narrow railroads may be better than wider ones there can be no doubt, any more than that baby wagons should be narrower than furniture trucks. The usual traffic of railroads, however, would be very poorly accommodated, and subjected to serious inconvenience, on a road with a gauge less than 4 ft. 8½ in. In fact, any one who has been engaged in the design or construction of cars or locomotives knows that the 3½ inches difference between 4 ft. 8½ in. and 5 ft. gauge would just give the requisite room which is needed for the fire-boxes of locomotives and the seats for passengers. To ride with comfort, each passenger should have a space for a seat not less than 18 inches wide. The aisle or passage-way of a car arranged on the American plan should be 24 inches wide, which, with 6 inches thickness for each side of the car, and 2 inches for the arm of the seat, will give a clear width for the car body of 9 feet 4 inches, which is as wide as it is practicable or safe to run cars on most 4 ft. 8½ in. gauge roads. Now what do the advocates of narrower gauges propose? Do they, as we believe has been done on the Festiniog Railway, intend to have the seats arranged in longitudinal rows, the passengers sitting with their backs to each other? To do that and retain a free passage-way from end to end of the cars would require very nearly or quite as much width as 9 feet 4 inches, unless great risks to the toes and tempers of passengers are assumed.

That skilful engineers having a new line of road to build, equip and manage, without any old prejudices to encounter or previous practice to remove, should be able to design the rolling stock so as to have less dead weight than is carried on older roads is not very surprising to any one who has had much experience. The same might be done with an entirely new road of 4 ft. 8½ in. gauge under similar conditions. This might especially be the case if the cars and engines were under the entire control and management of the designer and therefore sure to be handled with some care. Just as Charles Augustus, who drives his own dainty turn-out, will go on the road with a "buggy" so light that it looks as if it had been spun out of cobwebs, but Mr. Horsey, who keeps a livery stable across the way, knows too well that such "gear" would not be profitable in his business, to let to Tom, Dick and Harry. The gossamer wagons would be likely often to come home smashed, with many upbraidings from the lessee and lessor.

Cars must be built for the rough usage of people who have no interest, or at least take none, in handling them carefully, and are usually designed on the principle announced by our venerable "boss" in the days of apprenticeship: "Boys," he was wont to say, "if you make a thing too strong nobody will ever find it out, but if you make it too weak many people will soon hear of it." We do not say that it is altogether a wise maxim, but master mechanics, who so seldom receive credit and so often censure, are prone to act on principles which are safest to themselves.

* Even this could be obviated to a great degree by coning the tread of the wheels.

† It will be observed that we are referring exclusively to American cars. The point which we make is, that either Mr. Fairlie is wrong in the positions he has taken, or else American railroad practice is much better than English.

We are not advocating heavy rolling stock, only giving the reasons why it is made heavy.

In stating the proportion of non-paying to paying weight Mr, Fairlie says, "this disproportion is probably "due to the system of management pursued," etc. Does he mean that about seven wagons run empty to one loaded, or that their goods trains carry on an average only one-seventh of their capacity? If the proportion of dead weight of their passenger cars is no more than ours, then if the proportion of non-paying to paying weight is as 29 to 1, they must run with an average of only 2 passengers for every 7 they can carry. Certainly this would indicate a "system of management" utterly unknown here. We are inclined to believe it cannot be as wild as Mr. Fairlie's figures.

In explaining "why it is the average paying load now "carried on the Northwestern Railway bears so small a "proportion to the weight of the wagons employed in "carrying it," he says: "The reason is obvious enough. "The railway covers a large area of country, "and has great competition for the traffic, some "of which is of a very unequal character. Dispatch "in the shipment of freight is therefore necessary. "Suppose for example," he says, "that a person delivers "a bundle of chairs, or a quantity of any goods at a "station to be forwarded to some other station. The "station master cannot keep the chairs or goods until "he has a wagon load going to the same place, but "must dispatch them forthwith, perhaps alone in a "wagon that ought to carry ten times the quantity." Can it be possible that the London & Northwestern Railway, the good management of which Mr. Fairlie says is universally admitted, can be in the habit of conducting its business in this way, i. e. running cars loaded to only one tenth of their carrying capacity? That such exceptional cases might and do occur on all roads is well known, but that they occur often enough to form the basis of an argument like Mr. Fairlie's, or the text for a paper to be read before the British Association, would seem to an American railroad manager incomprehensible. The practice here is not to run one car for one bundle of chairs, but to pick up at each station not only the bundle of chairs, but the boxes and bales and everything else until the car is filled.

With reference to the first cost of narrow-gauge roads, we admit it will be less than wider ones, but in nothing like the proportion assumed by Mr. Fairlie. in this country roads costing £20,000 per mile are almost unknown, while there are many which have not cost £5,000, the minimum which Mr. F. proposes for his "new system." He has taken roads of the most expensive English construction and compared them with narrow gauge roads of the cheapest design, and from these premises attempts to prove his case. A comparrison of his figures with those representing the cost of any honestly constructed American road might surprise him.

He refers to the report of Mr. Hawkshaw to the Directors of the Eastern Bengal Railway, and from what Mr. Fairlie says of this report, we infer that the position Mr. H. has taken is, that if the only advantage of the narrow gauge is due to its light rolling stock, then it is a merit governed not by the width apart of the rails, but by the design of the cars and engines. In other words, that it is possible to have light rolling stock on a 4 ft. 8½ in. or even 5 ft. 6 in. gauge road.

This, Mr. Fairlie says, "is an admission that grave er-"rors have been made in designing that which is now "in use." This, we suppose, might be asserted of all human achievements, but it is difficult to see how this fact will do any service to the argument of Mr. Fairlie in favor of narrow-gauge roads. That Mr. Hawkshaw, or any one else, may have made errors in designing cars for a 5 ft. 6 in. or any other width of road, does not prove that two feet is the best distance apart for the rails.

The gauge of a railroad, like that of a common vehicle, is dependent on the traffic in which it is to be employed. By almost common consent, we find that the officers and those engaged in the practical operation and management of railroads in this country are agreed that 5 feet is in every way the most convenient and economical distance apart for the rails of roads doing any considerable business. The only reason for not going over 5 feet is, that it gives *more* room than is needed, just as less distance does not give enough. Unfortunately for us, however, when the first railroads were commenced here, in following the practice of English engineers we adopted the 4 ft. 8½ in. gauge, and the precedent once established, we have continued it ever since, excepting in the Southern States, where the majority of the roads are now 5-ft. gauge. The adoption of 4 ft. 8½ in. for the Pacific railroads has probably established for all time that distance between the rails in this country.

It may, however, be urged that although for main lines 5 feet may be the best gauge, yet for branches or feeders a narrow road would be preferable. In reply to this it is only necessary to speak of the constant necessity of running cars from the main line over the branch and *vice versa*. A break of gauge will require a conconstant reshipment at the junction of the main stem and branch. We purpose, however, to make a separate article, at some future time, on feeders of main lines, and in that we will try to show that we are not what Mr. Fairlie calls "enemies to progress and civilization."

Examination of Telegraphers.

The *Electric Telegraph and Railway Review*, a London journal, gives the following account of the examination to which are subjected candidates for appointments in the East India telegraph service. It will serve to illustrate further the system of examinations for corporate and government employes which we referred to last week in connection with an advertisement for candidates for a county surveyorship in Ireland. It should be remembered that this examination is not intended to ascertain the qualifications of telegraphers but to secure a select body of young men of good talent and general culture as *apprentices* to telegraphing, it being taken for granted that good telegraphers and men useful in the telegraph service are most likely to be developed from an able and highly educated body of men. A man is chosen for what he is likely to become as well as for what he is:

SCOPE OF EXAMINATION.

The first, or as we shall call it for the sake of distinction, the preliminary examination to be attended by nominees, is arranged under the following heads: History, divided into Greek, Roman, English and Indian, with a maximum of 250 marks in each, making 1,000 marks in all, out of which 400 are required as a minimum, in order (and this is an important point to mark) to enable the questionist to score at all under the head; Geography, Indian and General, 350 each, giving 700 as the maximum, 350 the minimum, as before; Mathematics, lower and higher, arranged as follows:

Arithmetic, including square and cube root	450	250
Mensuration	250	1·0
Book-keeping	250	100
Euclid, I., II., III., IV., and VI. Books	450	2·0
Algebra, to quadratic equations	450	200
Plane trgonometry, including heights and distances, and the use of logarithmic tables	650	300
Higher mathematics	1500	1·0

Giving in lower a maximum of 3,000, the minimum being fixed at a little less than one-half the marks in each subject; whilst higher mathematics, commanding 1,500 as the maximum, allows a student to score after a minimum of 150.

LANGUAGES.

Latin	500	100
Greek	500	100
Any one or two of the following modern languages, viz.: French, German, Italian, Hindustani; not more than two modern languages being permitted to be taken up	500	2·0

ART AND SCIENCE.

And lastly, Art and Science, thus distributed: Drawing 500, minimum 100 each in freehand and mechanical; chemistry, 500, minimum, 150; electricity and magnetism, 500, minimum 150; heat light and sound, 200, minimum 150. Thus is made up a minimum of 3,000, a maximum of 9,200 marks.

THE SELECTION.

Out of the nominees, the memorandum goes on to say, who qualify by gaining the above minimum, are selected in the order of merit, so many as may be needed, who are required to attend for not less than six months a physical class approved by the Secretary of State for further instruction in mathematics and physical science, and on producing a satisfactory certificate from the master to this effect, are then admitted to a second test examination. This passed, the student is required to place himself under a qualified telegraphic engineer. He is afterwards allowed to proceed to India, there to join the department as an assistant of the fourth class, at £240 per annum, to be increased to £270 on passing in one vernacular language at the end of one year. To cover the expense of study after the preliminary examination is passed, a grant of £100 to each student is made by Government, to which is added a further £100 on quitting England, to defray the expense of his passage. The memorandum then exhibits a table of the grades, with their stipends, of the whole staff in India, six in all, rising from £240 to the post of Director-General, at £3,600 per annum.

It is not likely that, should a similar system of examinations be introduced into this country, the "scope of examination" would be very similar to the above. Indeed, the tendency of the world, and not of America alone, is to recognize culture and discipline, however it may have been acquired; and if our telegraph and railroad managers ever take any pains to ascertain the mental cultivation of candidates for employment, we may be pretty sure that they will not insist that such cultivation shall have been secured by the study of Latin or Greek, but that they will recognize efficiency however attained. We imagine, too, that more stress will be put opon strictly professional acquirements, and that rapidity and skill as an accountant, accuracy in book-keeping, and familiarity with the principles if not the routine of business will be things more insisted on than more general culture. But here again it should be remembered that the object is rather to select promising candidates than skilled workmen. Something may be judged of a man's mental ability by his mental culture, and it is ability and not skill that is expected in youths who have their business to learn. When once they have entered upon their duties, examinations should be almost exclusively professional, and faithful and efficient service should count more than them all.

The Grand Trunk Report.

The report of the Grand Trunk Railway of Canada for the half year ending June 20, just made public in England, shows a revenue on the 1,377 miles operated by the company of £704,567, which is about $2,558 per mile of road. Only 968 miles of the 1,377 miles of road operated by the company is owned by it, and the amount expended on capital account for this mileage is $93,793,000, or something less than $100,000 per mile —more exactly, $96,861. As the gross earnings are less than 3 per cent. of this amount, it is easy to see why there are no dividends; but when we learn that nearly four-fifths of these gross earnings (79.43 per cent.) have been required to meet the operating expenses and the cost of renewals, we are only puzzled that nearly $45,000 was saved to apply on the interest of the first mortgage bonds.

Yet even this shows an improvement. Business has been largely increased, the company carrying 6.78 per cent. more passengers, and 17.67 per cent. more freight than in the corresponding half of last year. Rates were much lower, yet the gross earnings were greater by about 4⅕ per cent., and the net earnings by 2⅕ per cent. The road and rolling stock have been considerably improved also, and the floating debt discharged.

While it is hardly possible that the property will ever make anything like a reasonable return on the original investment, there is still good reason to believe that it will greatly improve—there being plenty of room in that direction and not much in the other. The completion of the Intercolonial Railway will give traffic to the whole line, and especially to the Quebec & Riviere du Loup Branch, which has hitherto been one of the most unprofitable lines in Christendom. While the Intercolonial is likely to have less local traffic than the Grand Trunk and to be altogether unprofitable, it is so situated that it may have a considerable through passenger and emigrant business, and all that it gets it must give to the Grand Trunk, and this will be a clear gain to the latter. When the line is complete, which will be within a year, we believe, travelers can leave steamers at Halifax and travel directly through to Quebec, Montreal, Toronto, Detroit, Chicago, Omaha or San Francisco. The ocean voyage is about two days shorter to Halifax than to New York, and it is not unlikely that many who don't like the sea but are compelled to cross it will choose the shortest route and go on board or land at Halifax.

Still more may be expected from the completion of the Buffalo bridge, though this will benefit but 260 miles of the road. When it can run its cars into the city of Buffalo it will be situated to obtain a much larger share of the freight business to and from New York.

It is estimated that the company would have made $150,000 more if the rates on freight had been kept up, and that there is a probability that these rates will be higher hereafter and the earnings greater in consequence. Probably rates will not very soon be so low as they were last summer, but the general tendency of what we may call standard rates is lower rather than higher. The business of all our trunk lines is increasing rapidly and improvements in operation and permanent way reduce operating expenses, so that rates may be reduced without affecting income. But it is only roads with an enormous traffic and low capital expenditure that can thrive on such rates. Lines having a very light traffic and a very heavy capital account suffer from every reduction, especially if they must compete with shorter as well as cheaper lines.

The Indianapolis, Cincinnati & Lafayette Railroad.

The railroad world was astonished a few days ago by the announcement that the above road had passed into the hands of receivers. The only explanation vouchsafed was that branches of the road were unprofitable. Nothing seems to be definitely known concerning the situation, but there are various rumors afloat, among which is one that the proprietors of the road were dissatisfied with their managers and had receivers appointed as a strategical movement, by which they could secure a change of policy without waiting until the next election. As, however, the election was held only a few days afterwards, this explanation needs explaining. Another explanation—and one not inconsistent with the above—is that the Pennsylvania Railroad Company has secured a controlling interest in the road, and took these legal measures in order to secure more immediate management of the property. Some time ago there was, or there was understood to be, an arrangement made between the Indianapolis, Cincinnati & Lafayette and the Baltimore & Ohio Company for an interchange of business, or some other close working connections, and it was understood that in this the latter company has acquired a valuable feeder of its Marietta & Cincinnati

line, and that, should no better line be secured, it might through it make a connection with Chicago by constructing an extension from Lafayette to Kankakee. If the Pennsylvania Company has acquired the line, it will be able to use it to advantage in connection with the various sections of the Columbus, Chicago & Indiana Central Railway. It will complete their line between Chicago and Cincinnati, give a feeder to the main line at Indianapolis, and afford the greater part of another line between Chicago and Cincinnati by way of Indianapolis. But it is hardly profitable to speculate on what may be done; for the rumor is only a rumor as yet, and a somewhat shadowy one at that.

The Kansas City, St. Joseph & Council Bluffs Railroad.

This railroad is one of the great river routes of America, and has more large towns on or close to its line than any other railroad of equal length west of the Mississippi, and indeed, there are few east of it which in the distance of 203 miles connect eight such towns as Kansas City, Leavenworth, Atchison, St. Joseph, Brownville, Nebraska City, Council Bluffs and Omaha. It is by this line, too, that St. Louis has its only direct connection with the Union Pacific Railroad, through trains running between that city and Council Bluffs over this and the North Missouri road.

The Missouri River towns on its line are among the most flourishing in the West and are growing in population so rapidly that by the close of the next decade we may reasonably expect that part of the Missouri valley to be as populous as any other section in the West. The numerous lines from the West, now in operation, in progress, or projected, must inevitably bring a large traffic to this line, which will afford an outlet to the East and South for their traffic. At the same time it is a section of the great north and south line of that territory, and will carry a large share of the traffic between Texas and Minnesota and Montana and the intervening district. Its Marysville Branch, extending northward from St. Joseph 61 miles nearly to the Iowa line has a very fertile district entirely to itself, and an extension further northward to the Burlington & Missouri River road will make it the outlet of a large traffic to and from Chicago.

The Louisville, Cincinnati & Lexington Line.

This railroad, since the completion of its Cincinnati line, which gives almost an air line between Louisville and Cincinnati, has become an important road to the country as well as to its section. For it is not only the shortest connection between the cities at its termini, but also a section in a great through line between New York and New Orleans. At present it is not in condition to compete to the greatest advantage, but when the Cincinnati bridge is completed and the connection with the Louisville & Nashville road in order, through trains between Louisville and New York will probably run over its line, and the largest part of the travel between New York and the Southwest, which passes by way of Louisville, be secured to this road. It is so situated as to command a very large share of the cotton and tobacco traffic, and its prosperity is hardly doubtful.

REGISTER OF EARNINGS.

FOR THE MONTH OF OCTOBER.

Chicago & Alton (465 miles), 1870	$488,658 24
" " (431 miles), 1869	468,212 51
Increase (4⅓ per cent.)	$20,445 73
Illinois Central (1107½ miles), 1870	$914,406 13
" (932 miles), 1869	862,171 24
Decrease (4⅝ per cent.)	$42,234 89
Michigan Central (284 miles), 1870	$511,447 06
" " (284 miles), 1869	490,772 18
Increase (4⅛ per cent.)	$20,674 48
Marietta & Cincinnati (251 miles), 1870	$183,531 00
" " (251 miles), 1869	132,869 00
Increase (15⅛ per cent.)	$20,662 00
Central Pacific (890 miles), 1870	$804,800 00
" " (690 miles), 1869	579,642 00
Increase (38¾ per cent.)	$225,158 00

FOR THE THIRD WEEK IN OCTOBER.

St. Louis & Iron Mountain (210 miles), 1870	$31,210 58
" " (210 miles), 1869	24,354 67
Decrease (28¼ per cent)	$6,885 91
Michigan Central (284 miles), 1869	$106,945 20
" " (284 miles), 1870	98,406 73
Decrease (8 per cent.)	$8,538 47

—The Keokuk (Iowa) *Gate City*, of last Saturday, says that in the case of Roberts *vs.* the Chicago, Burlington & Quincy Railroad, in which the plaintiff claimed $5,000 damages for falling on a defective platform, at Nashville, Iowa, in December, 1869, has been decided in favor of Roberts, to whom the court, however, only awarded $2,000 for injuries received.

Chicago Railroad News.

General Freight Agents' Convention.

The regular semi-annual meeting of the General Freight Agents' Association was held in the Sherman House, in this city, beginning at 11 o'clock a. m. on Wednesday, the 9th inst. The following members were present:

Lucien Hills, Cleveland, Columbus, Cincinnati & Indianapolis; H. C. Wicker, North Missouri; M. H. Smith, Louisville & Nashville; E. P. Wilson, Louisville, Cincinnati & Lexington; A. E. Shrader, Evansville & Crawfordsville; John C. Noyes, Indianapolis & St. Louis; W. G. McCoy, Louisville & Cincinnati Mail Boats; H. J. Page, Indianapolis, Cincinnati & Lafayette; S. Frink, St. Louis & Iron Mountain; L. Devenny, Cincinnati, Hamilton & Dayton; John T. Flynn, Memphis & Ohio; John B. Carson, Toledo, Wabash & Western; James Means, General Eastern Agent Pittsburgh, Cincinnati & St. Louis; J. A. Perkins, General Western Agent Pittsburgh, Cincinnati & St. Louis; E. F. Fuller, General Southern Agent Pittsburgh, Cincinnati & St. Louis; T. A. Lewis, General Western Superintendent Great Western Dispatch; W. G. Broughton, Gen. Supt., Belleville & Southern Illinois; H. C. Diehl, Indianapolis, Bloomington & Western; W. B. Strong, Burlington & Missouri River; H. J. Hayden, Missouri River, Fort Scott & Gulf; H. C. Hinman, Jeffersonville, Madison & Indianapolis; E. R. Wadsworth, Chicago, Burlington & Quincy; J. A. Semple, Cincinnati & Indianapolis Junction; J. W. Hobart, Vermont Central; L. Millis, General Agent National Dispatch; Lewis Viele, Chicago, Rock Island & Pacific; H. Brownson, Union Pacific; J. S. Cook, Peoria, Pekin & Jacksonville; E. S. Spencer, General Western Agent Erie Railway; O. E. Britt, Milwaukee & St. Paul; John Foggitt, Springfield & Illinois Southeastern; H. W. Hibbard, St. Louis, Vandalia, Terre Haute & Indianapolis; F. S. Van Alstine, General Southern Agent Union Line; L. N. Andrews, Indianapolis, Peru & Chicago; N. Stevens, General Agent St. Louis, Vandalia, Terre Haute & Indianapolis; W. H. Stennett, General Agent Illinois Central; J. F. Tucker, Illinois Central; D. S. Gray, 2d Vice-President and Acting General Freight Agent Pittsburgh, Cincinnati & St. Louis; Thos. Hoops, Michigan Central; F. H. Kingsbury, General Superintendent Union Line; James Smith, Chicago & Alton; C. C. Wheeler, Chicago & Northwestern; W. P. Shinn, Pittsburgh, Fort Wayne & Chicago; R. C. Meldrum, General Western Agent Pittsburgh, Fort Wayne & Chicago.

The President of the Association is C. W. Smith, of the Central Pacific. He being absent the chair was occupied by the Vice-President, Gen. E. R. Wadsworth, of the Chicago, Burlington & Quincy. H. W. Hibbard, of the St. Louis, Vandalia, Terre Haute & Indianapolis was Secretary.

Soon after assembling in the morning the Association adjourned until four o'clock in the afternoon. At that time the reports of committees being in order, that of the Committee on Classification of Freights, which was printed and circulated some months ago and has been thoroughly canvassed, was submitted for action. It appeared that all companies which had expressed an opinion were in favor of it, and nearly all had expressed their approval of it.

The following resolution was submitted by W. P. Shinn:

Resolved, That the classification submitted by the Executive Committee is hereby adopted by this Association, and the Chairman of the Executive Committee is hereby instructed to correspond with the New York Central & Hudson River Railroad Company, and upon securing its adoption by that company to give notice by circular, to all lines interested, of the fact, and the date when the same shall take effect, which shall not be less than thirty days from the date of his circular.

The resolution was adopted.

The changes made by the revised classification were announced on page 347, Vol. I, of the RAILROAD GAZETTE.

Mr. M. H. Smith offered the following resolution:

Resolved, That the resolution adopted at the convention of General Freight Agents held at Louisville Sept. 14, 1870, deducting 5 per cent. from the rate on compressed cotton loading 18,000 pounds and over to the car is hereby repealed.

This resolution was adopted.

The following resolutions were adopted:

WHEREAS, On the 16th day of June last, since the last meeting of this Association, our friend Thomas Carse, former Vice President of this Association, departed this life at the town of Nice, France, where he had gone in search of the health lost while laboring among us, and

WHEREAS, It is fitting that this Association take formal action expressive of our sorrow and regret at this sad event, therefore

Resolved, That in the death of Thomas Carse this Association has lost a most worthy officer and the members thereof a valued friend.

Resolved, That we tender to the bereaved family our heartfelt sympathy in their sad affliction

Resolved, That the Secretary furnish to the wife of the deceased a copy of this preamble and resolutions.

Mr. W. P. Shinn made some appropriate remarks concerning the life and character of Mr. Carse in connection with this resolution.

The following resolution was adopted:

Resolved, That we re-affirm the rates adopted at the meeting in Louisville September 14, based on $1.10 per 100 pounds from Memphis to New York on compressed cotton.

An invitation was received from the Union and Central Pacific companies, through their general freight agents, Mr. H. Brownson and Mr. C. W. Smith, asking the association to hold its next meeting in San Francisco, and requesting the members to bring their wives with them. A resolution was passed accepting this invitation, and the next annual meeting is to be held in San Francisco on the 12th of April next.

Resolutions of thanks to the Sherman House and press were passed.

The convention then adjourned.

Illinois Central.

The following report is made of receipts from land sales and traffic during October, 1867:

LAND DEPARTMENT.

Acres construction lands sold	5,672.48 for	$54,931 37
Acres interest fund lands sold		
Acres free lands sold	159.48 for	3,748 42
Total sales during month of Oct., 1870	5,832.29 for	$58,679 79
To which add town lot sales		149 00
Total of all	5,832.29 for	$58,819 79
Cash collected in October, 1870		$212,595 85

ESTIMATED EARNINGS—TRAFFIC DEPARTMENT.

	In Illinois 707 miles.	In Iowa 400½ miles.	Total. 1107½ mls.
Freight	$469,133 00	$113,196 00	$582,329 00
Passenger	157,635 99	48,831 25	206,467 24
Mails	6,375 00	1,129 08	7,404 08
Other Sources	64,000 00	1,970 92	65,970 92
Total, Oct., 1870	$707,143 99	$165,027 25	$862,171 24
Total actual earnings, Oct., 1869	$739,304 48	$175,201 65	$914,406 13
Decrease	$32,560 49	$10,174 40	$42,234 89

This is a falling off of 4⅓ per cent. on the Illinois lines, 5¾ per cent. on the Iowa lines, and 4⅝ per cent. on the entire traffic.

Lake Shore & Michigan Southern.

Mr. J. H. Devereux, the General Manager of this line, has removed his headquarters from Cleveland to Chicago. Mr. Devereux made a brilliant reputation on the United States military railroads during the war, and has increased it since.

This road brought into Buffalo during the month of October, 143,033 barrels of flour and 895,200 bushels of grain, and in the ten months of 1870, just past, 1,019,673 barrels of flour and 6,959,390 bushels of grain. This is nine-tenths of all the flour, and nearly two-ninths of all the grain received at that great grain receiving depot of the lakes.

Chicago & Alton

We call attention to an error in the last number of the RAILROAD GAZETTE by which the earnings of this road for the month of October, given in the "Register of earnings," was made to show a decrease in 1870. The dates of the years should have been reversed and "decrease" read "increase," as follows:

Earnings for the month of October:

1870	$488,658 24
1869	468,212 51
Increase (4⅓ per cent)	$20,445 73

Chicago, Rock Island & Pacific.

The earnings of this company for the month of September, as we quoted them on page 101 of the present volume, showed a decrease of $139,064 from those of the corresponding month of last year. An examination of the last annual report shows that in September, 1869, that portion of the earnings denominated "mails, *etc.*" is placed at $155,554, while this year it is about 15,000. We are informed that this variation is accounted for by the fact that in the annual report the receipts from stock sales, etc., for each month are included in the "etc." hence there was actually in the month of September, 1870, a small *increase* in the receipts from the operating department of the company.

Removal.

Wm. H. Hogan, agent of the South Shore Fast Freight Line has removed his office from No. 66 to No. 110 Clark. street. The present office is on the west side of the street, a little south of Washington.

Live Stock Shipments.

The following notice to shippers of live stock has been issued in this city:

"On and after Monday, November 1, 1870, until further notice, all live stock from Chicago to common or competing points East will be taken only by actual weight, as follows:

To Buffalo, Suspension Bridge, Pittsburgh and Bellaire	40	cents per 100 lbs.
To Dunkirk	37½	" "
To Cleveland	27½	" "
To Toledo and Detroit	25	" "

"The following minimum weights are the least that will be taken, and all excess of actual weight will be charged at the current rates:

Cattle,	per car	18,000 lbs
Horses,	"	20,000 lbs
Hogs, double deck car,	"	21,000 lbs
Hogs, single deck car,	"	14,000 lbs
Sheep, double deck car,	"	18,000 lbs
Sheep, single deck car,	"	14,000 lbs

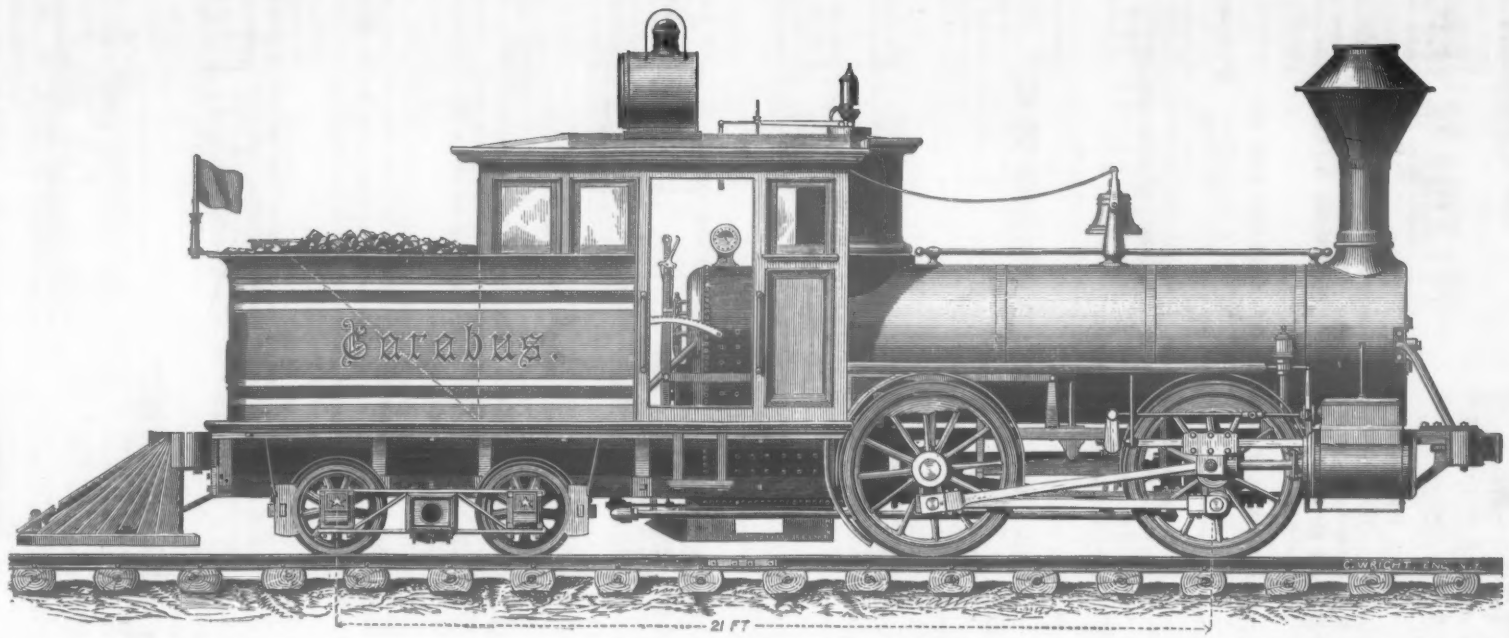
"No return passes will be given between any of these points, to shippers or men in charge of stock, and no passes, free tickets or inducements of any kind, on passenger trains in either direction.

WM. P. SHINN,
General Freight Agent, P., Ft. W. & C. Railway.
THOS. HOOPS,
General Freight Agent, Michigan Central Railroad.
C. M. GRAY,
Assistant General Freight Agent, L. S. & M. S. Railway.
D. S. GRAY,
2d Vice Pres't and Act'g Gen. Fr't Ag't P. C. & St. L. R'y."

Through Shipments to Liverpool.

Mr. R. C. Meldrum, General Western Freight Agent of the Pittsburgh, Fort Wayne & Chicago Railway, has lately made arrangements in New York with one of the best lines of steamers running between that port and Liverpool by which shipments may be consigned from Chicago directly to Liverpool and receipted for here. Blank bills of lading for Liverpool have been prepared, and shippers can make their contracts for rates, so that they can ascertain exactly the figures at which they can deliver produce in Liverpool. At present the chief direct trade is likely to be in flour and provisions, which Chicago supplies in large quantities for the English market.

Plate 1.



IMPROVED TANK LOCOMOTIVE.

Designed by

M. N. FORNEY, MECHANICAL ENGINEER.

No. 72 BROADWAY (Room 7), NEW YORK.

Weight with fuel and water	35 tons.
Capacity of Water Tank	1,500 galls.
Cylinder	14 inches in diameter, and 20 inches stroke.
Driving Wheels	50 inches in diameter.

PERSONAL.

—Mr. Perry H. Smith, late Vice-President of the Chicago & Northwestern Railway Company, and one of the founders and most efficient forwarders of that great enterprise, returned last Wednesday from Europe where he had been absent for more than a year. Mr. Perry will soon return to Europe, where he has left his family.

—Mr. M. M. Martin, the new Assistant General Superintendent of the Ohio & Mississippi Railway, will perform the duties of general purchasing agent and exercise a general supervision of the rolling stock and machinery

—Among the congressmen elected last Tuesday is Alexander Mitchell President of the Milwaukee & St. Paul Railway Company, who was the Democratic nominee in a district (the First Wisconsin) which has been carried by the Republicans for many years yet Mr. Mitchell had a majority of more than 3,000.

—Among the candidates of the Legislature in Chicago at the late election were Wm. B. Ogden and John B. Turner, who are among the most distinguished railroad men in the northwest; but the Legislature was not worthy of them—and they were defeated.

—The *Official Railway Guide* speaks as follows of Mr. A. A. Talmage, the new General Superintendent of the Indianapolis & St. Louis line: "Mr. Talmage cannot be surpassed by any of his confreres in the West for an accurate and practical knowledge of railroading in all its details, and should have acquired, from his long association with the road of which he is now General Superintendent, a thorough insight into the most profitable manner of utilizing its rapidly-increasing local business. His experience in various branches of the service has been equally varied and instructive. Commencing in 1852 as clerk in the freight department of the Erie Railway, Mr. Talmage subsequently removed in the following year to Chicago, and occupied a similar position in the service of the Michigan Southern & Northern Indiana Railroad, where he manifested such ability that he received the appointment of Train-Master, at Toledo, Ohio. Subsequently he removed to St. Louis, and was for six years passenger conductor on the St. Louis, Alton & Terre Haute Railroad, being promoted from that position to the Assistant Superintendency in the spring of 1864. After four months' experience of these duties he accepted employment on the military roads, and for nearly three years had charge of the lines operated by the United States Government south and east of Chattanooga. In December, 1867, upon the appointment of Mr. J. D. Herkimer as General Superintendent of the Indianapolis & St. Louis Railroad, Mr. A. A. Talmage became assistant, and has adhered to the road until now."

—Gen. W. J. Palmer, Director of Construction of the Kansas Pacific Railway, who distinguished himself for energy during the difficult extension of that road for Denver, is to sail for Europe on the 9th of next month.

TRAFFIC AND EARNINGS.

—The traffic receipts of the Grand Trunk of Canada for the week ending October 15 amounted to £34,100, against £32,800 in the corresponding week of last year, showing an increase of £1,300.

—Messrs Henry Clews & Co. publish the following estimate of earnings of the Burlington, Cedar Rapids & Minnesota Railroad Company when the road is completed:

Taking the average earnings of the Burlington, Cedar Rapids & Minnesota Railroad per mile, even at the present time, when the work of the road is being performed on disconnected portions, and computing for the whole distance of 170 miles at the same rate, we obtain an aggrate of $850,000 for gross annual returns. Allowing 50 per cent. for operating expenses, which will be a liberal estimate until the lapse of time shall have rendered new iron and rails necessary, the result—net earnings—is $425,000 to pay the interest on a bonded debt of $20,000 per mile, or more than 12 per cent. on the amount of the mortgage bonds.

We may assume, therefore, from the above exhibit of the existing traffic, that the following estimate will represent the income accruing on the completion of the enterprise after the first of December:

Receipts on 170 miles from Burlington to Cedar Falls, $8,000 per mile	$1,356,000
Operating expenses at 50 per cent. (annual rate for first 5 years	678,000
Net income	$678,000
Interest on bonds at 7 per cent. gold, equivalent to 8 per cent. currency	273,000
Earnings in excess of interest applicable to dividend on stock, being 12 per cent. on amount of stock, say $30,000 per mile	$405,000

—We have from Mr. S. T. Smith, Auditor of the Kansas Pacific Railway Company, the following estimated earnings of the company for the fourth week in October:

From freight:		
Ordinary	$7,530 00	
Government	13,250 00	
Total		$70,770 00
From passengers:		
First-class	$26,500 00	
U. S. troops	2,4 0 00	
U. S. mails	1,631 87	
Total		$30,521 87
Total estimate		$101,291 87
And for the month of October:		
From freight:		
Ordinary	$213,610 00	
Government	15,840 00	
Total freight		$229,450 00
From passengers:		
First-class	$98,400 00	
U. S. troops	9,000 00	
U. S. mails	6,487 48	
Total		$113,887 48
Total estimate		$343,337 48

—The White Line and the Union Line are to run their cars over the Indianapolis, Bloomington & Western Railway.

LOUISVILLE, CINCINNATI & LEXINGTON RAILROAD.

Report for the Year Ending June 30, 1870.

This company has a line from Louisville northwestward to Covington, opposite Cincinnati, 107 miles, and another from LaGrange, 27 miles east of Louisville, southwestward to Lexington, 67 miles.

The earnings of this road for the year ending June 30, were as follows:

From passengers		$502,378 88
From freight		391,836 50
From express		34,379 98
From mail		17,193 81
From telegraph		1,353 96
From miscellaneous		1,605 17
		$948,748 30
Expenses viz.:		
Conducting transportation	$224,079 81	
Motive power	139,781 93	
Maintenance of way	277,956 72	
Maintenance of cars	60,491 95	
General expenses	24,592 99	
		726,903 40
Net earnings		$221,844 90
Add balance on hand July 1, 1869		447,010 50
Profits in conversion of scrip		215 11
Total		$699,070 51
From which deduct—		
Interest on bonds	$207,762 06	
Dividends on preferred stock	80,406 87	
Interest and discount on loans	45,510 85	
State tax on capital stock	4,865 00	
Improved account	9,255 01	
Loss by defaulting agent	206 90	
Bills receivable, worthless	726 60	
		348,733 29
Balance to credit side of General Account		$350,337 22

The company was formed by the consolidation of the old Louisville & Frankfort and Lexington & Frankfort companies, which was agreed upon at the annual meeting in 1869, consummated on the 5th of October of that year, and ratified and confirmed by an act of the Kentucky Legislature last February.

One million dollars of additional 8 per cent. bonds were issued during the year, chiefly in lieu of preferred stock heretofore pledged on the floating debt, and for means to meet the cost of connections at Louisville and into Cincinnati. The President says:

"Your Short Line Branch road from Lagrange to Covington, though still uncompleted, has been open for business and in constant operation during the year past, and has made a gratifying success in demonstrating to the traveling and shipping public its comfort, capacity and safety as a first-class road. But the embarrasssment of its unfinished connections, both at Louisville and Cincinnati, with the necessary delay and expensive haul of both freight and passengers, have deprived it of the business to which its location and advantages entitle it, and essentially reduced the profits on the business it does command. These great obstacles have unavoidably existed a year too long; and have occasioned very serious loss and embarassment to the operations of the road and the finances of the company.

"The protracted controversy in the City Council as to the route of connection through Louisville has been terminated by a contract between this company, the Louisville & Nashville Railroad Company and the city of Louisville, fixing a satisfactory route for the construction of a connecting road at the joint cost of the two railroad companies; and we expect to be put in possession of the roadway and commence work upon its construction by the date of your meeting. The iron has been provided, and the connecting line should be finished and in operation by the middle of November. The connecting road through Newport will also be completed during the fall; and we have the most confident assurances that the railroad bridge across the Ohio River at Newport will be finished by the 1st of December.

"The funds required on our part to build these connections have been arranged for, at long time and lenient rates of interest, on pledge of the second bonds of the company, The strong companies with which we connect at either end have exhibited a gratifying interest and appreciation of the value of our connections in the liberal aid they have agreed to extend for its completion.

"I believe it is the history of all new roads that the first year of their opening has never developed the business they are to command; but in our case, operating an unfinished road, with a long break over which we have to haul at either end, against two competing roads without these embarrassments, and with scarcely any county roads open to our new depots on the line to command local business, the earnings exhibited for the past year can be no criterion from which to judge of or scarcely to estimate our future earnings. I believe the earnings of the new line will be at least doubled, and without any increase of expenditures, after the completion of its connections becomes generally known to the public. The operating expenses, which for the first five months of the past fiscal year look very large, but were necessarily greater on account of operating a new and unsettled road than ordinarily, have been reduced to about an average of fifty-six thousand dollars per month; at about which standard, or not exceeding sixty thousand per month, they can be maintained, even with a considerable increase of business and earnings. These expenditures include always a full monthly proportion of the annual outlay for rails, ties, and other material and labor necessary to keep up the renewals and repairs of the road and equipments in the best operating condition. The good condition and quality of the road bed, its tunnels, bridges, and culverts, are not only well maintained, but annually improved.

"Should our confident expectations of increased business on the new line be realized, the net revenues of the Company will at once exhibit a handsome margin above the current liabilities, on account of interest and dividends on preferred stock. But sound policy would dictate that the stockholders should not be urgent for a too hasty resumption of dividends on the common stock. The first surplus earnings available for dividends will be worth a great deal more to the common stock if applied to the reduction of the floating debt and the permanent retirement of the unsold preferred stock. The common stock of the company is so small in amount, compared with the length of the roads and value of property, that a comparatively small margin of net earnings above the interest account will pay good dividends. If the policy thus indicated be pursued, and no more preferred stock be sold, I am sanguine that within a few years the balance of the floating debt not paid by the sale of bonds will be paid off from earnings, and the common stock be in receipt of dividends at the rate of ten per cent. per annum."

The company have 26 locomotives, 10 twelve-wheel and 12 eight-wheel passenger cars, 8 baggage, 6 express 164 box, 24 stock, 100 platform, 6 caboose and 183 road cars. Number of miles run by locomotives with passenger trains, 376,178; with freight trains, 170,543; distributing trains, 74,184—total, 620,895; of which, 345,336 miles were run by coal burners, at a cost per mile for fuel of 8.37 cents and for repairs 2.72 cents; and 275,559 miles by wood burners, at a cost per mile for fuel o 10.79 cents, and for repairs 6.04 cents. Average cost per mile for fuel, 9.46 cents; and for repairs, 4.19 cents. Total cost per mile run, 24.79 cents. Total mileage of cars, 3,330,319. Number of passengers, 13,955,245. Average number of miles traveled by each passenger, 31.65. Number of tons hauled, 180,603; number of tons hauled one mile, 12,174,094; average distance each ton was hauled, 67.41 miles. Earnings per total revenue mile, $1 83.95; expenses, do., $1 40.94—net earnings do., $0 43.01. Expenses per total engine mile, $1 17.05. Proportion of operating expenses to earnings, 75.56.

The general account gives the cost of the Louisville & Lexington line, 93½ miles, as $2,186,910.36; of the Cincinnati Branch, 77 3-5 miles, $4,633,440.49. The company has other assets—stocks, real estate, supplies and cash—estimated at $207,459.21, making the value of the entire property $7,027,810.06. There is $1,500,000 of 9 per cent. preferred stock, $1,623,482.82 of common stock, a perpetual 6 per cent. loan from the State of Kentucky of $74,519.50, $1,000,000 of 8 per cent., $3,000,000 of 7 per cent., and $207,000 of 6 per cent. mortgage bonds—a total bonded debt of $4,207,000.

The directors of the company, elected by the stockholders, are Joshua F. Speed, J. Guthrie Coke, J. W Kalfus, J. M. Monohan, G. Spratt, J. B. Wilder, G. W. Sutton, M. C. Johnson, F. K. Hunt, Henry Bell. By the State of Kentucky, J. Lyttleton Cooke, E. D. Standiford.

President, Norvin Green; Vice President, Joshua F. Speed; General Superintendent, Samuel Gill; Assistant Superintendent, J. E. Gimperling; Secretary and Treasurer, W. H. Beynroth; Auditor, Wm. Mahl; Engineer, G. R. Talcott.

—At about half-past 1 o'clock on the morning of the 10th inst. a fire broke out in the large transfer house of the New York Central Railroad Company at East Buffalo, near the cattle yards, destroying the building and three hundred empty cars. The loss is estimated at over $600,000. The fire is supposed to have been set by an incendiary. A portion of the rolling stock belonged to the Lake Shore & Michigan Southern Railway Company.

—The British Post Office Department gives notice that, owing to the interruption of mail communication through France; the overland Indian mails will be sent hereafter through Belgium and Germany, over the Brenner Pass, to Brindisi, and by Italian mail packets to Alexandria.

PUBLISHER'S ANNOUNCEMENTS.

Railroad Gazette Binders.

We are prepared to furnish such of our subscribers as wishto preserve files of the RAILROAD GAZETTE with "Alden's Ready Book Binder," at the following charge: In leather and cloth, $1.10; in cloth and paper, 90 cts. This binder is made the proper size for our pages, and is sufficiently large to accommodate twenty-six numbers. It makes a book as fast as the numbers are inserted and is adurable binding when complete.

Printers' Copying Ink.

We referred, some two weeks since, in this department, to the "Printers' Copying Ink" used by Messrs. Helfenstein & Lewis, railroad and commercial printers, of Philadelphia, and in so doing perhaps conveyed a wrong impression. The firm referred to are not *dealers* in this ink, but from their extensive printing house are prepared to furnish railroad companies and others with blanks printed in black, or in any or all colors, which have the rare quality of copying in an ordinary letter copying press as readily as the best copying ink used for writing purposes. The style of their work, as evidenced by the numerous specimens at hand, is accurate and in excellent taste. Their busines address is, northeast corner Fifth and Chestnut streets, Philadelphia, Pa.

—Brazil has now about 400 miles of railroad open for traffic. This total is made up as follows: Pedro Segundo Railroad, 133 miles; San Paulo Railroad, 85 miles; Bahia & San Francisco Railroad, 75 miles; Recife, & San Francisco Railroad, 76 miles; Canta Gallo Railroad, 21 miles; and Mana or Petropolis Railroad, 10 miles. Several extensions and new lines are either projected or are in actual course of construction. The net profits realised upon the open lines increased in 1869 to the extent of about 33 per cent. as compared with 1868.

—The total amount of revenue collected upon the railways of Italy in the first eight months of this year was £2,415,419, as compared with £2,314,053 in the corresponding period of 1869, showing an increase of £101,366. The length of line in working at the close of August 3,662½ miles, as compared with 3,345 miles at the close of August, 1869.

WANTS.

☞ SHORT ADVERTISEMENTS will be inserted under this head at ten cents per line for the first insertion, and five cents per line for each subsequent insertion.

WANTED.—Twenty-five cents each will be paid for a few perfect copies of the first quarto volume of the RAILROAD GAZETTE of the following dates: June 25, August 13 and August 20, all 1870. Address A. N. KELLOGG, No. 101 Washington street, Chicago.

WANTED—Every Railway Traveler in the United States and the Dominion of Canada wants every railway company to use the Thomas Safety Baggage Check. It is in use on over sixty of the best managed roads in the country and has been during the past three years, and not one piece of baggage to which this check has been attached has been lost or miscarried. Every railroad man upon whose road it is in use says:

"*We are fully satisfied after a thorough trial and practical use of the Thomas Safety Baggage Check that both for local and through business it has no equal. It is cheaper, more satisfactory and better adapted to the business than any other check in use.*"

All information in reference to the Thomas Safety Baggage Check will be given by addressing G. F. THOMAS, editor Appleton's Railway Guide, 90, 92 and 94 Grand Street, New York.

WANTED—A Civil Engineer of considerable experience in this and the Old Country is open for an engagement as Divisional Engineer, or in any business connected with Surveying—unquestionable references. Address CIVIL ENGINEER, care of Editor RAILROAD GAZETTE.

Great Western R. W. of Canada.

The Directors of the Great Western Railway of Canada invite tenders for the construction of the Second Division of the CANADA AIR LINE.

Plans and specifications for the Division from *Aylmer* to *Simcoe* will be on exhibition at the office of the Chief Engineer, George Lowe Reid, Esq., Hamilton, from the 8th to the 25th November.

All Tenders must be in the hands of the undersigned by 10 o'clock on the morning of the 25*th* instant—sealed and marked "Tender for construction of Second Division Canada Air Line"

JOSEPH PRICE, Treasurer, etc.
Chief Office, Hamilton, Ontario, Nov. 7, 1870.

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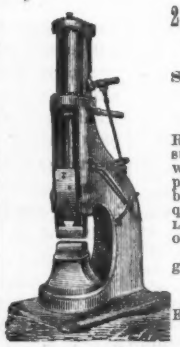

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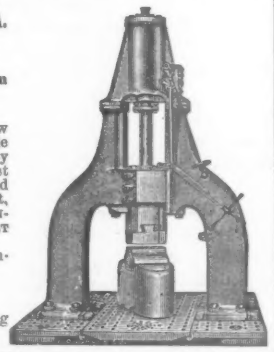

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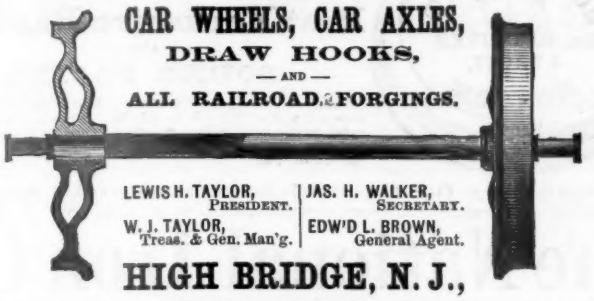

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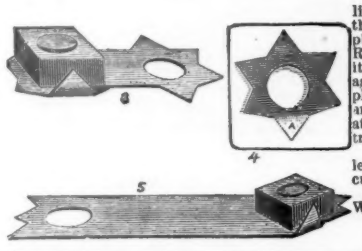

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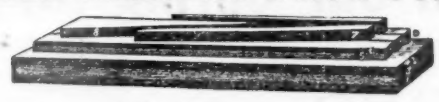

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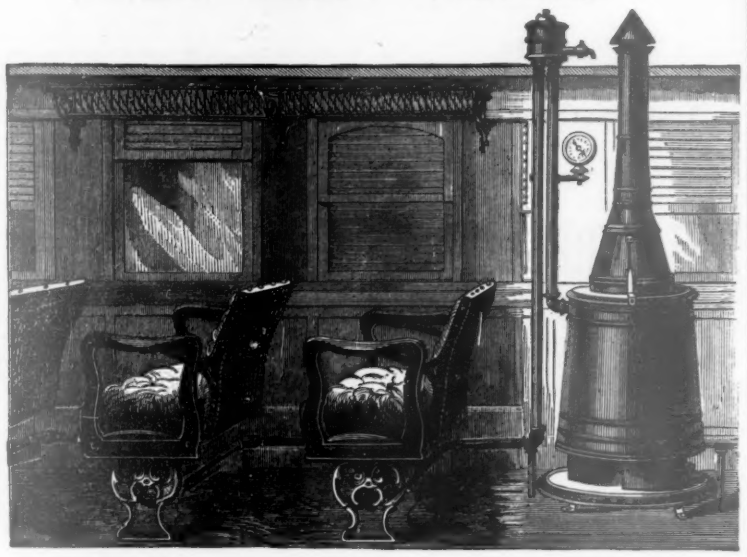

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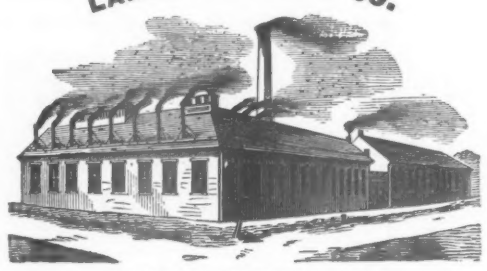

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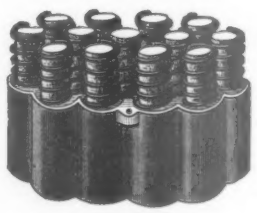

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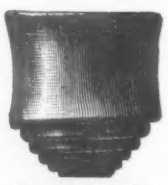

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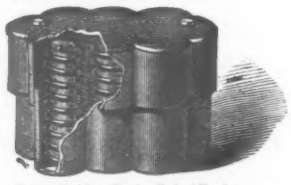

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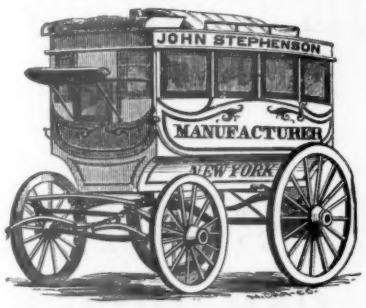

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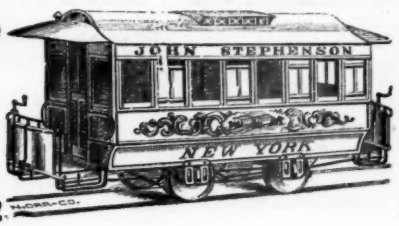

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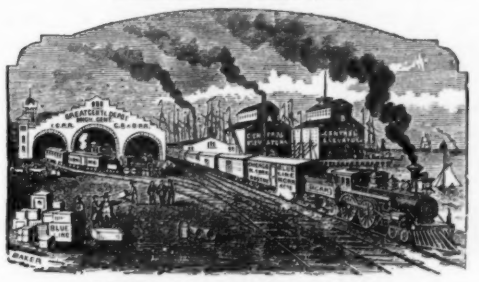

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WYOMING, COLORADO, &C.

The most available Passenger and Freight Route to Lawrence, Topeka, Junction City, Abilene, Salina, Hays, KIT CARSON, River Bend, DENVER, CHEYENNE, OGDEN, SALT LAKE CITY,

Sacramento, and San Francisco.

☞ Close Connections are made in Union Depots at KANSAS CITY and STATE LINE with Express Trains of the HANNIBAL & ST. JOSEPH, NORTH MISSOURI and MISSOURI PACIFIC RAILROADS.

Southern Overland Passenger and Mail Coaches leave Kit Carson daily for Pueblo, Trinidad, Fort Union, Santa Fe, &c.

Hughes & Co.'s Splendid Concord Coaches leave Denver daily for Central City, Georgetown, &c.

Passenger and Freight Rates always as low and conveniences as ample as by any other Route.

PULLMAN'S PALACE CARS ACCOMPANY NIGHT EXPRESS TRAINS.

Through Tickets can be obtained at all principal ticket offices. Be careful to ask for tickets via Kansas Pacific Railway, "Smoky Hill Route."

5,000,000 Acres of Farming Lands For Sale!

Situated along the line of this Great National Railway. For particulars, address JNO. P. DEVEREUX, Land Commissioner, Lawrence, Kansas.

R. B. GEMMELL, Gen. Freight & Ticket Agt. **A. ANDERSON, Gen. Supt.**

THE ERIE & PACIFIC DISPATCH CO.

Are Authorized Freight Agents.

For information, Contracts, and Bills of Lading, apply at their office, 64 Clark Street, Chicago.

H. H. RAPP, AGT.

J. E. FRENCH. W. S. DODGE. D. W. CROSS.

Winslow Car Roofing Company.

PATENT IRON CAR ROOFS.

Established, 1859.

No. 211 Superior St. CLEVELAND, O.

Over 20,000 Cars covered with this Roof! We claim that these Roofs will keep Cars dry, and will last as long as the Cars they cover without any extra expense after once put on.

☞ SEND FOR CIRCULARS.

CHICAGO & NORTHWESTERN R. W.

Comprising the PRINCIPAL RAILROADS from CHICAGO Directly NORTH NORTH-WEST and WEST.

ALL RAIL TO THE PACIFIC OCEAN!

Great California Line.

TRAINS LEAVE WELLS STREET DEPOT AS FOLLOWS:

8:15 A. M. Cedar Rapids Pass	**9:15 P. M. Night Mail.**
10:30 A. M. Pacific Express.	**9:15 P. M. Rock Island Pass.**
10:30 A. M. Rock Island Exp.	**4:00 P. M. Dixon Passenger.**

For Sterling, Rock Island, Fulton, Clinton, Cedar Rapids, Boone, Denison, Missouri Valley Junction, Sioux City, Council Bluffs and Omaha, there connecting with the

UNION PACIFIC R. R.

For Cheyenne, Denver, Ogden, Salt Lake, the White Pine Silver Mines, Sacramento, San Francisco, and all parts of Nebraska, Colorado, New Mexico, Arizona, Wyoming, Montana, Idaho, Utah, Nevada, and the PACIFIC COAST.

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
To OMAHA,.....	23	$20.00	To SACRAMENTO,.	4½	$118.00
" DENVER,.....	52	70.75	" SAN FRANCISCO, 5		118.00

TRAINS ARRIVE:—Night Mail, **7.00** a. m.; Dixon Passenger, **11.10** a. m.; Pacific Express, **3:50** p. m.; Rock Island Express, **3:50** p. m.; Cedar Rapids Passenger, **6:50** p. m.

FREEPORT LINE.

9.00 A. M. & 9.45 P. M. For Belvidere, Rockford, Freeport, Galena, Dunleith, and St. Paul.

4.00 P. M., Rockford Accommodation.
5.30 P. M., Geneva and Elgin Accommodation
6.10 P. M., Lombard Accommodation.
5:50 P. M., Junction Passenger.

TRAINS ARRIVE:—Freeport Passenger, **2:30** a. m., **3:00** p. m.; Rockford Accommodation, **11:10** a. m.; Geneva and Elgin Accommodation, **8:45** a. m.; Junction Passenger, **8:10** a. m.; Lombard Accommodation, **6:50** a. m.

WISCONSIN DIVISION.

☞ Trains leave Depot, cor. West Water and Kinzie Sts., daily, Sundays excepted, as follows:

10.00 A. M. **DAY EXPRESS,** for Janesville, Monroe, Whitewater, Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Neenah, Appleton, and Green Bay.

4.00 P. M., Janesville Accommodation.

5.00 P. M. **NIGHT EXPRESS,** for Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Menasha, Appleton, Green Bay, and THE LAKE SUPERIOR COUNTRY.

5.30 P. M., Woodstock Accommodation.
6:20 P. M., Barrington Passenger.

TRAINS ARRIVE:—**5:30** a. m., **7:45** a m., **1 :10** a. m., **1:00** p. m. and **7:15** p. m.

MILWAUKEE DIVISION.

MILWAUKEE MAIL,	**8:00 A. M.**
EXPRESS, (ex. Sun.) Waukegan, Kenosha, Racine and Milwaukee,	**9:45 A. M.**
EVANSTON PASSENGER,	**11:40 A. M.**
HIGHLAND PARK PASSENGER,	**1:15 P. M.**
MILWAUKEE ACCOMMODATION, with Sleeping Car attached	**11:00 P. M.**
EVANSTON ACCOMMODATION, (Daily,) from Wisconsin Div. Depot	**1:30 P. M.**
KENOSHA ACCOMMODATION, (Sundays excepted) from Wells St. Depot	**4:15 P. M.**
AFTERNOON PASSENGER, from Milwaukee Div. Depot	**5:00 P. M.**
WAUKEGAN ACCOMMODATION, (except Sundays) from Wells St. Depot	**5:25 P. M.**
WAUKEGAN PASSENGER, (Sundays excepted) from Wells St. Depot	**6:15 P. M.**

TRAINS ARRIVE:—Night Accommodation, with Sleeping Car, **5:00** a. m.; Day Express, **4:10** p. m. Milwaukee Mail, **10:10** a. m.; Afternoon Passenger, **8:00** p. m.; Waukegan Accommodation, **8:25** a. m.; Kenosha Accommodation, **9:10** a.m.; Evanston Accommodation, **1.40** and **4.00** p. m.; Waukegan Passenger, **7:55** a. m.; Highland Park Passenger, **3.45** p. m.

PULLMAN PALACE CARS ON ALL NIGHT TRAINS.

THROUGH TICKETS Can be purchased at all principal Railroad Offices East and South, and in Chicago at the Southeast corner of Lake and Clark Streets, and at the Passenger Stations as above.

H. P. STANWOOD, Gen. Ticket Agt.
GEO. L. DUNLAP, Gen'l Supt.

Western Union Railroad.

CHICAGO & NORTHWESTERN DEPOT, CHICAGO. | MILWAUKEE & CHICAGO DEPOT, MILWAUKEE.

THE DIRECT ROUTE!

CHICAGO, RACINE & MILWAUKEE,

—TO—

Beloit, Savanna, Clinton, Pt. Byron, Davenport, Mineral Point, Madison, Freeport, Fulton, Lyons, Rock Island, Sabula, Galena, Dubuque, Des Moines, Council Bluffs,

OMAHA, SAN FRANCISCO

AND ALL PRINCIPAL POINTS IN

Southern and Central Wisconsin, Northern Illinois, and Central and Northern Iowa.

FRED. WILD, Gen. Ticket Agent.
D. A. OLIN, Gen. Superintendent.

CRERAR, ADAMS & CO.,

MANUFACTURERS AND DEALERS IN

Railroad Supplies!

—AND—

CONTRACTORS' MATERIAL.

11 and 13 Wells Street,

CHICAGO, ILL.

Manufacturers of IMPROVED HEAD-LIGHTS for Locomotives, Hand and Signal Lanterns, Car and Station Lamps, Brass Dome Casings, Dome Mouldings, Cylinder Heads, and Car Trimmings, of Every Description.

Pan-Handle

—AND—

Penn'a Central Route East!

☞ SHORTEST AND QUICKEST ROUTE, VIA COLUMBUS, TO ☜

PITTSBURGH, BALTIMORE, PHILADELPHIA & NEW YORK

On and after Saturday, JULY 10th, 1870, Trains for the East will run as follows:

[DEPOT CORNER CANAL AND KINZIE STS., WEST SIDE.]

8:10 A. M. DAY EXPRESS.

[SUNDAYS EXCEPTED.] Via Richmond. Arriving at

COLUMBUS	2:35 A. M.	HARRISBURG..	10:35 P. M.	NEW YORK....	6:40 A. M.	WASHINGTON..	5.50 A. M.
PITTSBURGH..	12:00 M.	PHILADELPHIA	3:10 A. M.	BALTIMORE..	2:30 A. M.	BOSTON.....	5:05 P. M.

7:40 P. M. NIGHT EXPRESS.

[SATURDAYS EXCEPTED.] Arriving at:

COLUMBUS..	11:15 A. M.	HARRISBURG..	5:10 A. M.	NEW YORK..	12:10 P. M.	WASHINGTON.	1:10 P. M.
PITTSBURGH..	7:05 P. M.	PHILADELPHIA,	9.35 A. M.	BALTIMORE...	9:00 A. M.	BOSTON.....	11:50 P. M.

Palace Day and Sleeping Cars

Run Through to COLUMBUS, and from Columbus to NEW YORK, WITHOUT CHANGE!

ONLY ONE CHANGE TO NEW YORK, PHILADELPHIA, OR BALTIMORE!

CINCINNATI & LOUISVILLE AIR LINE SOUTH.

35 Miles the Shortest Route to Cincinnati.
18 Miles the Shortest Route to Indianapolis and Louisville.

2 Hours the Quickest Route to Cincinnati!

THE SHORTEST AND BEST ROUTE TO

Columbus, Chillicothe, Hamilton, Wheeling, Parkersburg, Evansville, Dayton, Zanesville, Marietta, Lexington, Terre Haute, Nashville,

ALL POINTS IN CENTRAL & SOUTHERN OHIO, & INDIANA, KENTUCKY & VIRGINIA.

— QUICK, DIRECT AND ONLY ALL RAIL ROUTE TO —

New Orleans, Memphis, Mobile, Vicksburg, Charleston, Savannah,

AND ALL POINTS SOUTH.

Cincinnati, Indianapolis and Louisville Trains run as follows:

THROUGH WITHOUT CHANGE OF CARS!

8:10 A. M. (Sundays excepted) Arriving at		7:40 P. M. (Saturdays excepted.) Arriving at	
LOGANSPORT	1:15 P. M.	LOGANSPORT	1:30 A. M.
KOKOMO	2:33 P. M.	KOKOMO	2:45 A. M.
CINCINNATI	9:30 P. M.	CINCINNATI	10:30 A. M.
INDIANAPOLIS	5:00 P. M.	INDIANAPOLIS	5:40 A. M.
LOUISVILLE	11:30 P. M.	LOUISVILLE	8:30 P. M.

Lansing Accommodation: Leaves 5:10 P. M. Arrives 8:55 A. M.

PULLMAN'S PALACE SLEEPING CARS!

Accompany all Night Trains between Chicago and Cincinnati or Indianapolis.

☞ Ask for Tickets **via COLUMBUS** for the East, and **via "The AIR LINE"** for Cincinnati, Indianapolis, Louisville and points South. Tickets for sale and Sleeping Car Berths secured at **95 RANDOLPH STREET, CHICAGO,** and at Principal Ticket Offices in the West and Northwest.

WM. L. O'BRIEN, Gen. Pass. and Ticket Agent, Columbus.
I. S. HODSDON, Northwestern Pass. Agt., Chicago

D. W. CALDWELL Gen Supt. Columbus.

MOORE
Steel Elastic Car Wheel Co.

OF NEW JERSEY.

Proprietors of

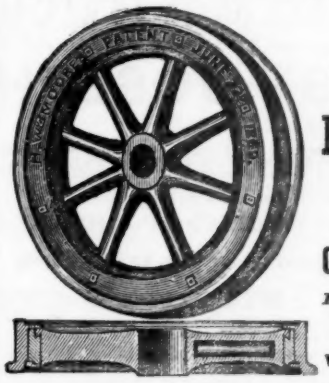
MOORE'S PATENT

FOR THE MANUFACTURE OF

ELASTIC CAR WHEELS,

FOR PASSENGER AND SLEEPING COACHES.

Noiseless, Safe, Durable and Economical.



Also, Manufacturers of

CAR WHEELS OF EVERY DESCRIPTION.

H. W. MOORE, President.
JAS. K. FROTHINGHAM, Secretary.
F. W. BLOODGOOD, Treasurer.

Works, cor. Green and Wayne Sts., JERSEY CITY, N. J.
P. O. Address—Box 129, Jersey City, N. J.

American Compound Telegraph Wire.

More than 3000 Miles now in Operation,

Demonstrating beyond question its superior working capacity, and great ability to withstand the elements. For RAILROAD LINES, connecting a single wire with a large number of Stations, and for long circuits, this wire is peculiarly adapted; the large conducting capacity secured by the copper, with other advantages, rendering such lines fully serviceable during the heaviest rains.

Having a core of steel, a small number of poles only are required, as compared with iron wire construction, thereby preventing much loss of the current from escape and very materially reducing cost of maintenance OFFICE AMERICAN COMPOUND TELEGRAPH WIRE CO.
234 West 29th Street, New York.

BLISS, TILLOTSON & CO., Western Agents.
247 South Water Street, Chicago.

THE FAVORITE THROUGH PASSENGER ROUTE!

Chicago, Burlington & Quincy
RAILROAD LINE.

3 THROUGH EXPRESS TRAINS DAILY!

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
TO OMAHA, - - -	23	$20.00	TO DENVER, - -	2½	$65.00
" ST. JOSEPH, - -	21	19.50	" SACRAMENTO, -	4½	118.00
" KANSAS CITY, -	22	20.00	" SAN FRANCISCO,	5	118.00

TRAINS LEAVE CHICAGO from the Great Central Depot, foot of Lake Street, as follows:

BURLINGTON, KEOKUK, COUNCIL BLUFFS & OMAHA LINE

7:40 A. M. **MAIL AND EXPRESS,** (Except Sunday,) stopping at all stations; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Galena, Dunleith, Dubuque, LaSalle, El Paso, Bloomington, &c.

10:45 A. M. **PACIFIC FAST LINE,** (Except Sunday,) stopping at Riverside, Hinsdale, Aurora, Leland, Mendota, Princeton, Buda, Kewanee, Galva, Galesburg, and all stations West and South of Galesburg.
☞ ELEGANT DAY COACHES and **PULLMAN PALACE DRAWING ROOM CARS** are attached to this train daily from Chicago

TO COUNCIL BLUFFS & OMAHA WITHOUT CHANGE!

5.00 P. M. **EVENING EXPRESS,** (Daily, except Saturday,) for Burlington, Ottumwa, DesMoines, Nebraska City, Council Bluffs, Omaha, and all points West. **Pullman Drawing Room Sleeping Car** attached to this Train daily from **Chicago to Ottumwa,** and Elegant Day Coaches, from **Chicago to Council Bluffs and Omaha, without change!**

11:30 P. M. **NIGHT EXPRESS,** (Daily, except Saturday,) stopping at all principal Stations between Chicago and Burlington. Elegant Day Coaches, and a **Pullman Palace Sleeping Car** are attached to this Train from **Chicago to Burlington, without change!** This is the Route between

CHICAGO, COUNCIL BLUFFS & OMAHA,
—RUNNING THE CELEBRATED—
Pullman Palace Dining Cars!

49 MILES THE SHORTEST ROUTE BETWEEN

Chicago & Keokuk,
And the Only Route Without Ferrying the Mississippi River!

QUINCY, ST. JOSEPH, LEAVENW'TH & KANSAS CITY LINE.

10:45 A. M. **PACIFIC EXPRESS,** (Daily, except Sunday,) with ELEGANT DAY COACHES and PULLMAN'S PALACE SLEEPING CARS attached, running through from Chicago to KANSAS CITY, **Without Change!**

5:00 P. M. **EVENING EXPRESS,** (Daily,) with **Pullman Palace Drawing Room Sleeping Car** attached running through from Chicago to QUINCY, KANSAS CITY, LAWRENCE, TOPEKA and DENVER, WITHOUT CHANGE.

11:30 P. M. **NIGHT EXPRESS,** (Daily, except Saturday,) with **Pullman Palace Sleeping Car** attached from Chicago to GALESBURG: PALACE DAY COACHES from Chicago to QUINCY, **Without Change!**

64 MILES THE SHORTEST AND ONLY ROUTE BETWEEN

Chicago and Kansas City!
WITHOUT CHANGE OF CARS OR FERRY.

115 MILES The Shortest Route bet. Chicago & St. Joseph.

THE SHORTEST, BEST AND QUICKEST ROUTE BETWEEN CHICAGO AND

Atchison, Weston, Leavenworth, Lawrence,

AND ALL POINTS ON THE KANSAS PACIFIC R'Y.

Local Trains Leave { RIVERSIDE & HINSDALE ACCOMMODATION.7:00 A. M. 1:30 & 6:15 P.M.
MENDOTA PASSENGER.....4:15 P. M.
AURORA PASSENGER.....5:30 P. M.

Ask for Tickets via Chicago, Burlington & Quincy Railroad, which can be obtained at all principal offices of connecting roads, and at Company's office in Great Central Depot, Chicago at as low rates as by any other route.

ROB'T HARRIS, Gen'l Superintendent, CHICAGO.
SAM'L POWELL, Gen'l Ticket Agent, CHICAGO.
E. A. PARKER, Gen. West. Pass. Agt., CHICAGO.

THE GREAT THROUGH PASSENGER ROUTE TO KANSAS
IS VIA THE OLD RELIABLE

HANNIBAL & ST. JOSEPH
SHORT LINE.

Crossing the Mississippi at Quincy and the Missouri at Kansas City on New Iron Bridges; running Three Daily Express Trains, Through Cars and Pullman Sleeping Palaces from Chicago & Quincy to St. Joseph & Kansas City.

The Advantages gained by this Line over any other Route from Chicago, are:

115 MILES THE SHORTEST!

To St. Joseph, Atchison, Hiawatha, Waterville, Weston, Leavenworth,

64 MILES THE SHORTEST!

To Kansas City, Fort Scott, Lawrence, Ottawa,

Garnett, Iola, Humboldt, Topeka, Burlingame, Emporia, Manhattan, Fort Riley, Junction City, Salina, Ellsworth, Hays, Sheridan, Olathe, Paola, Cherokee Neutral Lands, Baxter Springs, Santa Fe, New Mexico, and all Points on the KANSAS PACIFIC, and MISSOURI RIVER, FT. SCOTT & GULF R. R's, with which we connect at Kansas City Union Depot.

THIS BEING THE SHORTEST LINE AND QUICKEST, is consequently the cheapest; and no one that is posted thinks of taking any other Route from Chicago to reach principal points in

Missouri, Kansas, Indian Territory, or New Mexico.

DAILY OVERLAND STAGES from west end Kansas Pacific Railway, for Pueblo, Santa Fe, Denver, and points in Colorado and New Mexico.

THIS is also a most desirable Route, via St. Joseph, to Brownsville, Nebraska City, Council Bluffs, and Omaha, connecting with the Union Pacific Railroad for Cheyenne, Denver, Salt Lake, Sacramento, San Francisco, and the Pacific coast.

Through Tickets for Sale at all Ticket Offices. Baggage Checked Through, and Omnibus Transfers and Ferriage avoided.

P. B. GROAT, Gen. Ticket Agent. HANNIBAL, MO
GEO. H. NETTLETON, Gen. Supt. HANNIBAL, MO.

Old, Reliable, Air-Line Route!

CHICAGO, ALTON & ST. LOUIS R. R.

SHORTEST, QUICKEST AND ONLY DIRECT ROAD TO

Bloomington, Springfield, Jacksonville, Alton
— AND —
ST. LOUIS!
WITHOUT CHANGE OF CARS.

THE ONLY ROAD MAKING IMMEDIATE CONNECTIONS AT ST. LOUIS WITH MORNING AND EVENING TRAINS

—FOR—

ATCHISON, LEAVENWORTH, KANSAS CITY,
Lawrence, Topeka, Memphis, New Orleans,

And All Points South and Southwest.

☞ TRAINS leave CHICAGO from the West-side Union Depot, near Madison Street Bridge. ☜

EXPRESS MAIL, [Except Sundays]	8:10 A. M
LIGHTNING EXPRESS, [Except Saturdays and Sundays]	9:50 P. M.
NIGHT EXPRESS, [Daily]	6:00 P. M.
JOLIET ACCOMMODATION. [Except Sundays]	4:40 P. M.
JACKSONVILLE EXPRESS, [Daily]	6:00 P. M.

Trains arrive at Chicago at 8.00 P. M., 8.30 A. M. and 6:00 A. M. Joliet Accom., 9.40 A. M.

This is the ONLY LINE Between CHICAGO & ST. LOUIS RUNNING

Pullman's Palace Sleeping and Celebrated Dining Cars!

BAGGAGE CHECKED THROUGH.

Through Tickets can be had at the Company's office, No. 55 Dearborn street, Chicago, or at the Depot, corner of West Madison and Canal streets, and at all principal Ticket Offices in the United States and Canada. Rates of Fare and Freights as low as by any other Route.

A. NEWMAN, Gen. Pass. Agent. **J. C. McMULLIN, Gen. Supt.**

North Missouri R. R.
PASSENGERS FOR
KANSAS AND THE WEST,
ARE REMINDED THAT
THE NORTH MISSOURI R. R.
— IS —
11 MILES SHORTER than any other Route!
BETWEEN
St. Louis and Kansas City.
15 Miles Shorter between ST. LOUIS and LEAVENWORTH
— AND —
49 MILES SHORTER TO ST. JOSEPH!
THAN ANY OTHER LINE OUT OF ST. LOUIS.

☞ **Three Through Express Trains Daily!** ☜

Pullman's Celebrated Palace Sleeping Cars on all Night Trains!

☞ **FOR TICKETS,** apply at all Railroad Ticket Offices, and see that you get your Tickets via St. Louis and North Missouri Railroad.

C. N. PRATT, Gen. Eastern Agt., 111 Dearborn-st. CHICAGO.
S. H. KNIGHT, Gen. Superintendent, ST. LOUIS.

JAS. CHARLTON, Gen. Pass. and Ticket Agt., St. Louis.

Pacific Railroad of Missouri.

THE MOST DIRECT AND RELIABLE ROUTE FROM ST. LOUIS THROUGH TO

KANSAS CITY, LEAVENWORTH & ATCHISON,
☞ WITHOUT CHANGE OF CARS! ☜

Close Connections at KANSAS CITY with Missouri Valley, Missouri River, Ft. Scott & Gulf, and Kansas Pacific R'ys, for Weston, St. Joseph, Junction City, Fort Scott, Lawrence, Topeka, Sheridan, Denver, Fort Union, Santa Fe, and

ALL POINTS WEST!

☞ At SEDALIA, WARRENSBURG and PLEASANT HILL, with Stage Lines for Warsaw, Quincy, Bolivar, Springfield, Clinton, Osceola, Lamar, Carthage, Granby, Neosho, Baxter Springs, Fort Gibson, Fort Smith, Van Buren, Fayetteville, Bentonville.

PALACE SLEEPING CARS on all NIGHT TRAINS.

Baggage Checked Through Free!

THROUGH TICKETS for sale at all the Principal Railroad Offices in the United States and Canadas. **Be Sure and Get your Tickets over the PACIFIC R. R. OF MISSOURI.**

W. B. HALE, Gen. Pass. and Ticket Agt.
THOS. McKISSOCK. General Superintendent.

THREE HOURS IN ADVANCE OF ALL OTHER ROUTES!

Sixty-One Miles the Shortest Line! Only 27 Hours!

— FROM —

CHICAGO TO NEW YORK.

Pittsburgh, Ft. Wayne & Chicago and Pennsylvania Central

IS THE ONLY ROUTE RUNNING ITS ENTIRE TRAIN THROUGH TO PHILADELPHIA AND NEW YORK, AND THE ONLY ROUTE RUNNING

THREE DAILY LINES OF PULLMAN'S DAY AND SLEEPING PALACES,

— FROM CHICAGO TO —

PITTSBURGH, HARRISBURG, PHILADELPHIA & NEW YORK,

☞ WITHOUT CHANGE! ☜

WITH BUT ONE CHANGE TO

BALTIMORE, PROVIDENCE, NEW HAVEN,

HARTFORD, SPRINGFIELD, WORCESTER AND BOSTON!

And the Most Direct Route to Washington City.

☞ Trains Leave WEST SIDE UNION DEPOT, corner West Madison and Canal Streets, as follows:

LEAVE:	Mail	Fast Express.	Pacific Exp.	Night Exp.	VALPARAISO ACCOMMODATION. Leaves CHICAGO daily, (except Sunday,) at 4:50 P. M.
CHICAGO	5.50 A. M.	11.00 A. M.	5.15 P. M.	9.00 P. M.	
PLYMOUTH	9.50 "	1 50 P. M.	s. 9 10 "	2.13 A. M.	
FORT WAYNE	12.40 P. M.	3.20 "	11.30 "	B. 5.30 "	
LIMA	3.15 "	.... "	1.25 A. M.	8.10 "	
FOREST	4.37 "	.... "	2 48 "	9 40 "	
CRESTLINE	6.00 A. M.	s. 6.55 "	4.30 "	D 12.05 P. M.	
MANSFIELD	6.42 "	7.16 "	5.00 "	12.34 "	
ORRVILLE	9 05 "	8 42 "	6 45 "	2.27 "	
ALLIANCE	10 45 "	9.55 "	B. 8.40 "	3.55 "	
ROCHESTER	D. 2 05 P. M.	12.17 A. M.	10.53 "	6.02 "	South'n Exp.
PITTSBURGH	3.15 "	12.50 "	12.45 P. M.	s. 7.50 "	5.30 A. M
BLAIRSVILLE BRANCH	6.05 "	.... "	2.49 "	9.54 "	7.23 "
JOHNSTOWN	6.56 "	.... "	3.37 "	10.42 "	8.08 "
CRESSON	7.58 "	.... "	4.38 "	11.43 "	9.04 "
ALTOONA	s. 9.05 "	B. 4.40 "	s. 5.45 "	12.35 A. M.	B.10.05 "
HUNTINGDON	10.21 "	.... "	7.04 "	1.45 "	11.14 "
LEWISTOWN	11.44 "	.... "	8.23 "	2.59 "	12.25 P. M.
HARRISBURG	2.10 A. M.	8.23 "	10.45 "	5.20 "	D. 2.50 "
LANCASTER	3.40 "	.... P. M.	12.15 A. M.	7.00 "	4.10 "
DOWNINGTON	5.00 "	.... "	1.40 "	B. 8.16 "	5.35 "
ARRIVE:					
PHILADELPHIA	6.30 "	12.20 "	3.10 "	9.40 "	7.00 "
NEW YORK, VIA PHILADELPHIA	10.41 "	3.00 "	6.43 "	1.00 P. M.	10.26 "
NEW YORK, VIA ALLENTOWN	.. ..	3.50 "	.....	12.05 P. M.	.....
BALTIMORE	....	12.10 "	4.30 "	9.00 A. M.	7.00 "
WASHINGTON	....	3.40 "	5.50 "	1.00 P. M.	10.00 "
BOSTON	9.00 P. M.	5.50 A. M.	5.05 P. M.	11.50 "	.....

THE FAST EXPRESS Leaves Chicago daily, except Sunday; the entire Train.—Baggage, Day and Pullman's Palace Cars—RUNNING THROUGH from Chicago to New York, via Mantua Junction; leaves Pittsburgh daily, except Monday. This train **reaches NEW YORK in time to make close connection for BOSTON!** No other Route through New York makes it! Arrives in BALTIMORE **Five Hours,** and WASHINGTON **Four Hours in Advance of Rival Routes!**

THE PACIFIC EXPRESS Leaves Chicago and Pittsburgh daily, for Philadelphia and New York, with PULLMAN PALACE CARS from Chicago; leaves Harrisburg for Baltimore daily, except Sunday; has SLEEPING CARS from Chicago to Pittsburgh, and from Altoona to Philadelphia. This train arrives in BALTIMORE **Nine Hours,** and WASHINGTON **Seven Hours, in Advance of all other Lines!**

THE NIGHT EXPRESS Leaves Chicago daily, except Saturday and Sunday; leaves Pittsburgh daily, except Sunday; leaves Harrisburg for Baltimore daily; has PULLMAN'S PALACE CARS from Chicago to Philadelphia and New York; has SLEEPING CARS from Chicago to Crestline, and from Pittsburgh to New York, Philadelphia and Baltimore. This train reaches BALTIMORE **Three Hours in Advance of competing Routes!**

THE MAIL Leaves Chicago daily, except Sunday, stopping at all Stations, and reaching Crestline the same evening [where passengers can transfer to Day Express]; leaves Crestline [Express,] the next morning, and leaves Pittsburgh daily, except Sunday. SLEEPING CARS from Pittsburgh to Philadelphia.

THE SOUTHERN EXPRESS Leaves PITTSBURGH daily, except Monday, with SILVER PALACE CARS to Philadelphia and New York; leaves Harrisburg for Baltimore daily, except Sunday.

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☞ WITHOUT TRANSFER OF PASSENGERS! ☜

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4 EXPRESS TRAINS DAILY, [Sundays Excepted,] Leave Chicago from the New Depot, on Van Buren St., at the head of La Salle Street, as follow

7:30 A. M. MAIL TRAIN.
VIA OLD ROAD AND AIR LINE. SUNDAYS EXCEPTED.

Leaves 22d Street 7:45 A. M. Stops at all Stations. **Arrives**—Toledo, 6:20 P. M.

11:30 A. M. SPECIAL NEW YORK EXPRESS,
-A AIR LINE. SUNDAYS EXCEPTED.

Leaves—Twenty-Second Street, **11:45 A. M. Arrives**—Elkhart, 2:55 P. M.; Cleveland 10:40 P. M.; Buffalo, 4:10 A. M.; New York, 5:30 P. M.; (Chicago Time) Boston, 11:45 P. M.

This Train has PALACE SLEEPING COACH Attached, Running

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Only Thirty Hours, Chicago to New York!

5:15 P. M. ATLANTIC EXPRESS (Daily),
VIA OLD ROAD.

Leave—Twenty-Second Street **5:30 P. M. Arrives**—Laporte, 8:10 P. M. (Stops 20 minutes or Supper); arrives at Toledo, 2:50 A. M.; Cleveland, 7:25 A. M. (20 minutes for Breakfast); arrives at Buffalo, 1:50 P. M.; Rochester, 5:10 P. M. (30 minutes for Supper); connects with **Sleeping Coach running Through from Rochester to Boston Without Change,** making but **One Change between Chicago and Boston.**

NEW AND ELEGANT SLEEPING COACH Attached to this Train, Running THROUGH from CHICAGO TO NEW YORK WITHOUT CHANGE! Arrives at NEW YORK, 6:40 A. M.

9:00 P. M. NIGHT EXPRESS
VIA AIR LINE. (DAILY EXCEPT SAT. & SUN.)

Leaves—Twenty-Second Street, **9:15 P. M. Arrives**—Toledo, 6:00 A. M. (20 minutes for Breakfast); arrives at Cleveland, 10:35 A. M.; Buffalo, 5:30 P. M.; New York, 11:00 A. M.; Boston, 3:50 P. M.

KALAMAZOO DIVISION.

Leave Chicago 11:30 A. M. Arrive at Kalamazoo 5:30 P. M.; Grand Rapids, 8:15 P. M.

Leave Chicago 9:00 P. M. Arrive at Kalamazoo 7:10 A. M.; Grand Rapids, 10:20 A. M.

Elkhart Accommodation leaves Chicago, 3:30 P. M. Arrives at Elkhart, 8:20 P. M.

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THROUGH LINE.

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Arriving in ST. LOUIS at 10:15 P. M.

☞ This Train Reaches St. Louis ONE HOUR & FIFTEEN MINUTES in Advance of any other Route! ☜

8:30 P. M. FAST LINE. Saturdays Excepted.
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8:30 P. M. CAIRO EXPRESS, Except Saturdays.
Arriving at **Cairo** 3:15 P. M., **Memphis** 2:30 A. M., **Vicksburg** 5:00 P. M., **New Orleans** 1:30 A. M.

4:55 P. M. CHAMPAIGN PASSENGER,
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HYDE PARK TRAIN...	*8:00 A. M.	*9.15 A. M.	HYDE PARK TRAIN,....	*6:10 P. M.	*7:35 P. M
HYDE PARK TRAIN,..	*12:10 P. M.	*1:50 P. M.			

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5:00 A. M. MAIL TRAIN. Stops at all Stations.
(SUNDAYS EXCEPTED.) Arrives DETROIT at 5:40 P. M.

11:30 A. M. SPECIAL NEW YORK & BOSTON EXP.
(SUNDAYS EXCEPTED.) Arrives at Michigan City 1:13 P. M.; New Buffalo 1:32, Niles 2:15, [Dinner], Kalamazoo 3:52 P. M.; Battle Creek 4:28, Marshall 4:48, Jackson 5:45, Detroit 7:55, London 12:05, A. M Hamilton 2:35 A. M; Toronto 9 20, Suspension Bridge 3:55, Rochester 7:00 A. M; Albany, 2:00 P. M.; NEW YORK, 6:25, BOSTON, 11:50 P. M. ☞ This train connects at ROCHESTER 7:00 A. M.) with

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(DAILY.) Arrives at Michigan City, 7:18 P. M.; Niles 8:30 P. M. [Supper]; Kalamazoo, 10:25 P. M.; Jackson, 1:00 A. M.; Detroit 3:40, London, 8:35, [Breakfast]; Hamilton 11:40, Suspension Bridge 1:30 P. M.; Rochester 5:00 P. M.; Albany, 1:30 A. M.; NEW YORK, 6:40 A. M.; BOSTON, 11:00 A. M.
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9:00 P. M. NIGHT EXPRESS.
(SAT. & SUN. EXCEPTED). Arrives at Michigan City, 11:03 P. M.; Niles, 12:25 A. M.; Kalamazoo, 2:00; Marshall, 3:12; Jackson, 4:25; Grand Trunk Junction, 7:00; Detroit, 7:30; London, 1:45 P. M.; Hamilton, 4:35; Toronto, 9:35; Niagara Falls, 6:15; Buffalo, 7:15 P. M.; Rochester, 9:10; Syracuse, 12:25 A. M.; Rome, 1:55; Utica, 2:25; Albany, 6:30 A. M.; NEW YORK, **10:00 A. M.**; BOSTON, **3:40 P. M.**

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4:30 P. M. AFTERNOON EXPRESS.
(EXCEPT SATURDAY) Arriving at Michigan City 6:30 P. M. [Supper]; LaFayette, 11:30 P. M. Indianapolis, 2:15 A. M.; Louisville, 7:00 A. M.; Nashville, 4 00 P. M.

A GOOD SLEEPING CAR is Attached to this Train Every Night,
And goes from Chicago to Louisville WITHOUT CHANGE!

☞ **SPECIAL NOTICE.**—This Train stops at Michigan City for Supper, and waits at that point for Michigan Central Atlantic Express East, leaving Chicago at 4:45 p. m. Passengers going South, and wishing as much time in Chicago as possible, can take the 4:45 p. m. Michigan Central Atlantic Express, and connect without fail at Michigan City, with above Through Louisville Express.

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Open to Grand Rapids.

11:30 A. M. AND **9:00** P. M. **Trains from Chicago Connect at Kalamazoo**

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